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INDEX OF EXPENDITURES ON NEW PLANT AND EQUIPMENT FOR SELECTED INDUSTRIES, 1947-1957

Chemical and Rubber Industries Establish New Highs in 1956

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A NEW FAMILY OF ELASTOMERS
By G. E. Meyer et al., page 529

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URETHANE ELASTOMERS . . . . . W. G. Ogden 537

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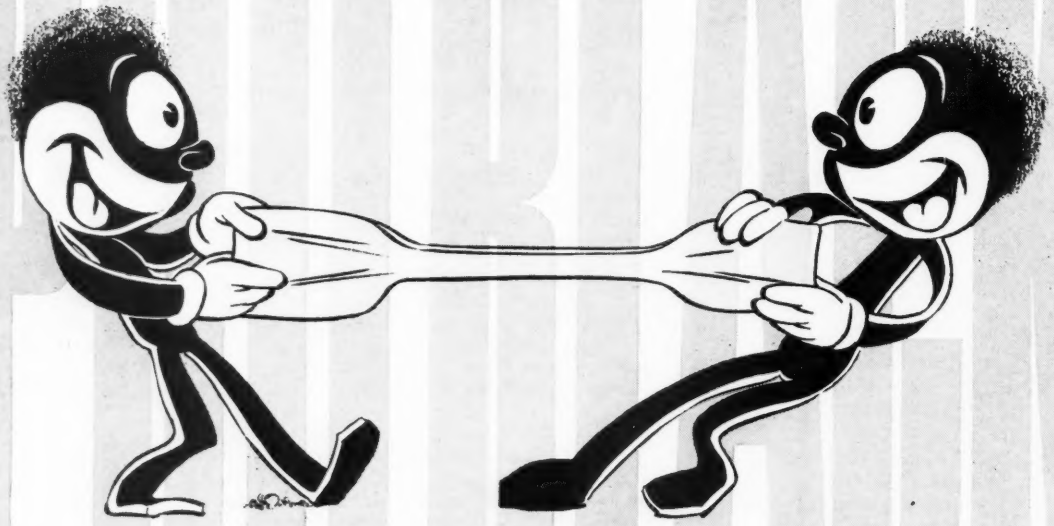

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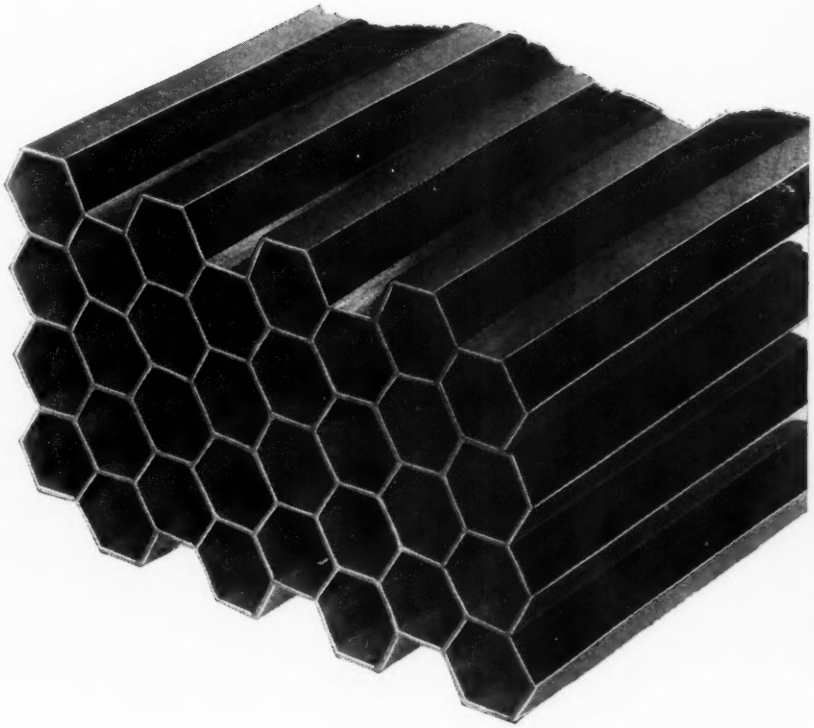
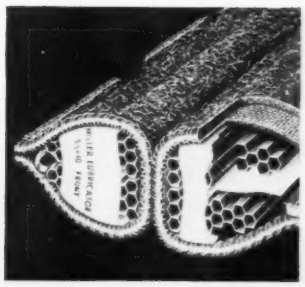
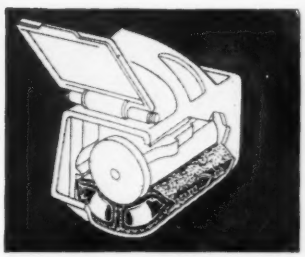




Lubricator for freight car journal boxes manufactured by Miller Lubricator Company, Winona, Minn. Hycar rubber is used in honeycomb spring core. Hycar latex is used as anchor for pad threads.



Cutaway drawing showing journal box application of lubricator pad that stops "hot boxes". Resilient Hycar core permits easy pad installation, assures uniform pad-journal contact and withstands oil immersion.

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For information on Hycar, write Dept. HN-7, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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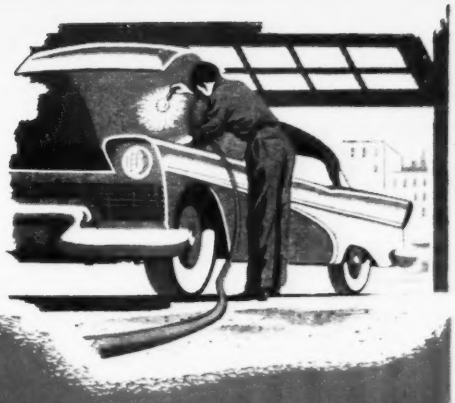

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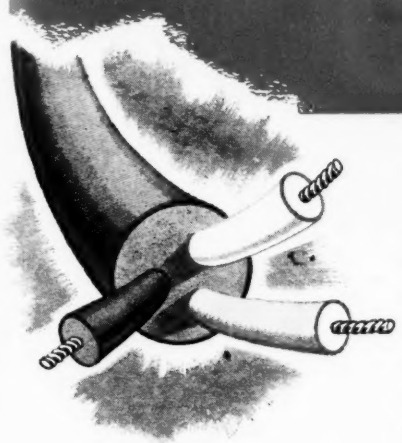

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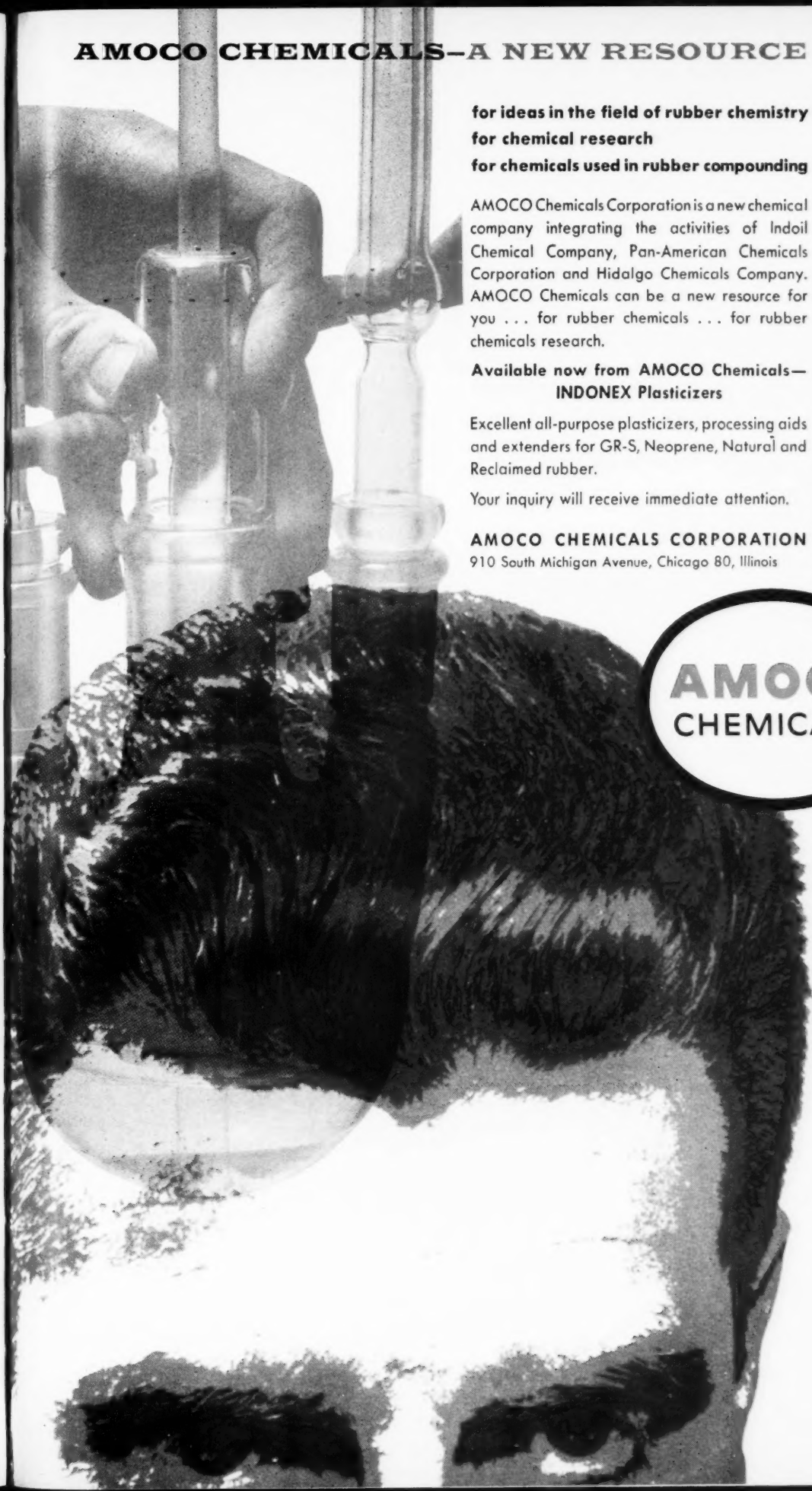

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The nation's need for oil grows daily. And with it grows the importance of rubber hose as a link between well and market.

It used to be that the vital stream of petroleum products frequently was interrupted by premature hose failures. Complaints were commonplace, users changed brands often and hose manufacturers could do little to improve the situation.

The picture changed, however, with the introduction of CHEMIGUM – first of the nitrile rubbers–back in 1940. Through the years, the outstanding resistance of CHEMIGUM has helped immeasurably to reduce the flow of complaints on hose failures to a mere trickle. And each year has seen a steady improvement in the quality and processability of this unusual rubber.

To handle oil, solvents and chemicals, CHEMIGUM is also used by rubber manufacturers in pump linings, diaphragms, seals, packings, O-rings, hard-rubber pipe and fittings, as well as in hose and mechanical goods. As either a manufacturer or purchaser of rubber products, you stand to benefit from an appraisal of CHEMIGUM and what it can do for you. Whatever your interest in rubber products, you will find our latest manual informative and helpful. Write for "A New Look at Nitrile Rubber," to:

Goodyear, Chemical Division, Dept. G-9418, Akron 16, Ohio.

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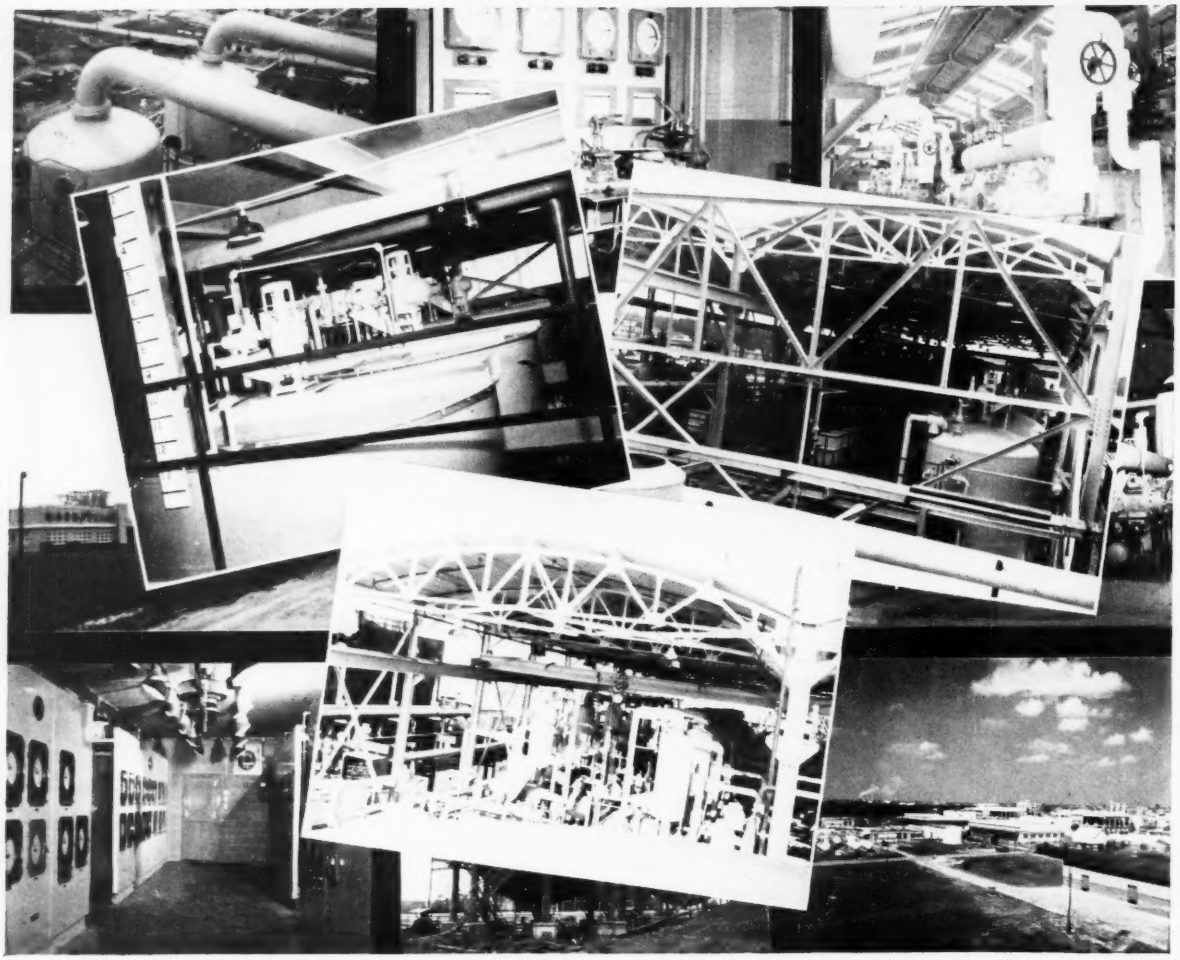

Here's big news, even for Texas!

During its days of Government ownership, the synthetic rubber plant in Houston, Texas, was big and efficient. But since Goodyear assumed ownership in 1955, even the eyes of Texas have been opened by the big changes taking place. For today, with completion of a 50% expansion, the Houston facility has become the world's largest single synthetic rubber plant – and the most modern, too.

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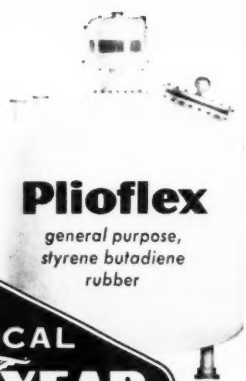

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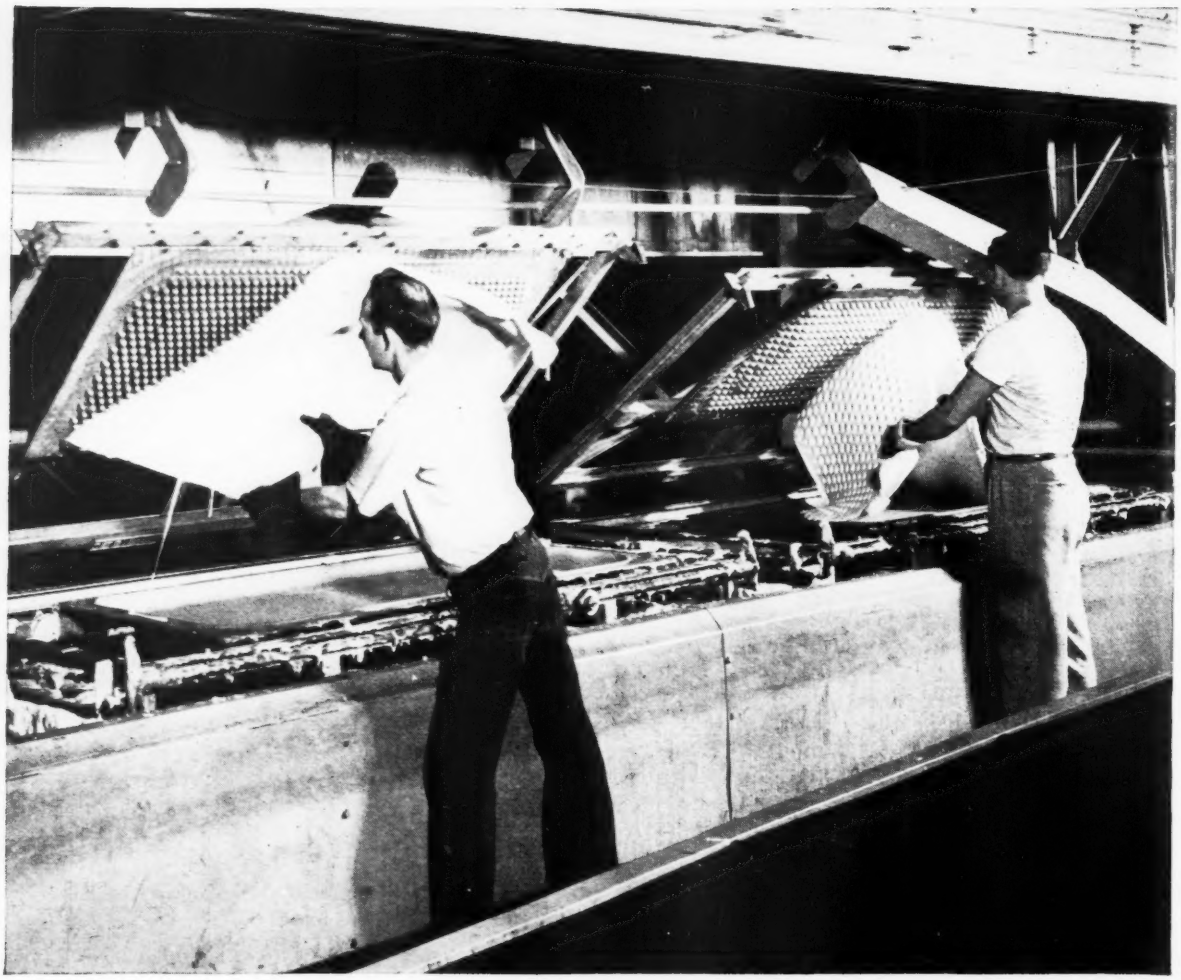

What's first and foremost for foam?

First and foremost choice of a number of manufacturers of foamed rubber products is one of two Goodyear latices–PLIOLITE LATEX 2104 or PLIOLITE LATEX 2105.

PLIOLITE LATEX 2104 is a "cold" polybutadiene latex which exhibits virtually no odor. This feature plus its high solids content and excellent mechanical stability make PLIOLITE LATEX 2104 extremely well-suited to the production of pillows, mattresses and other types of cushioning.

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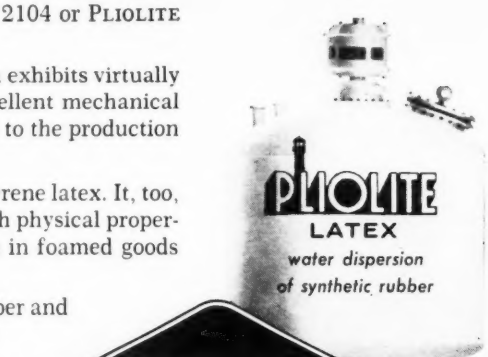
In addition to these latices, there are a number of other rubber and resin latices in the PLIOLITE family. Each can be used alone or in combination with the others to obtain specific properties in foam or any of the many applications for latex.

Details plus the latest *Tech Book Bulletins* on PLIOLITE LATEX are yours by writing to:

Goodyear, Chemical Division, Akron 16, Ohio



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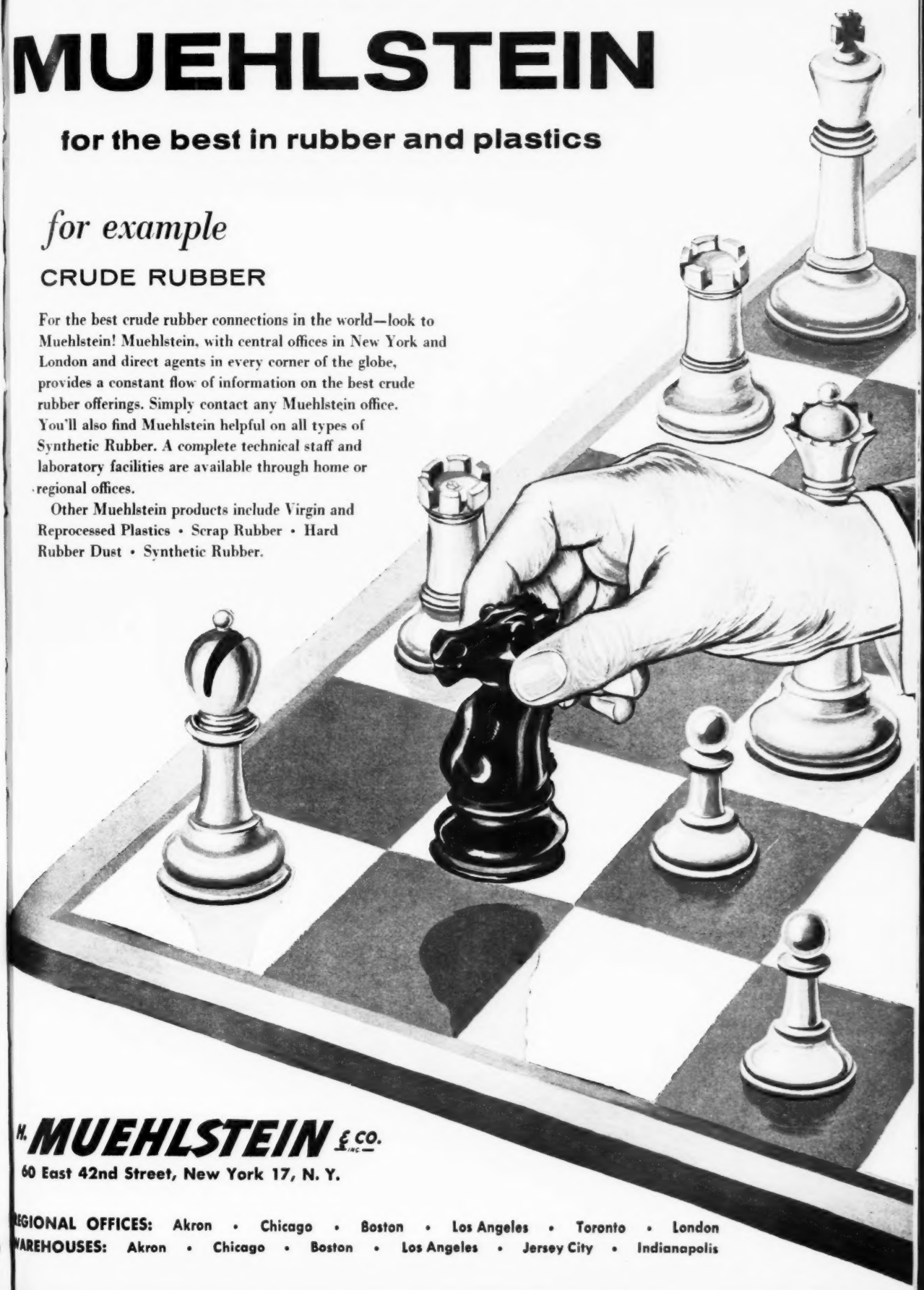

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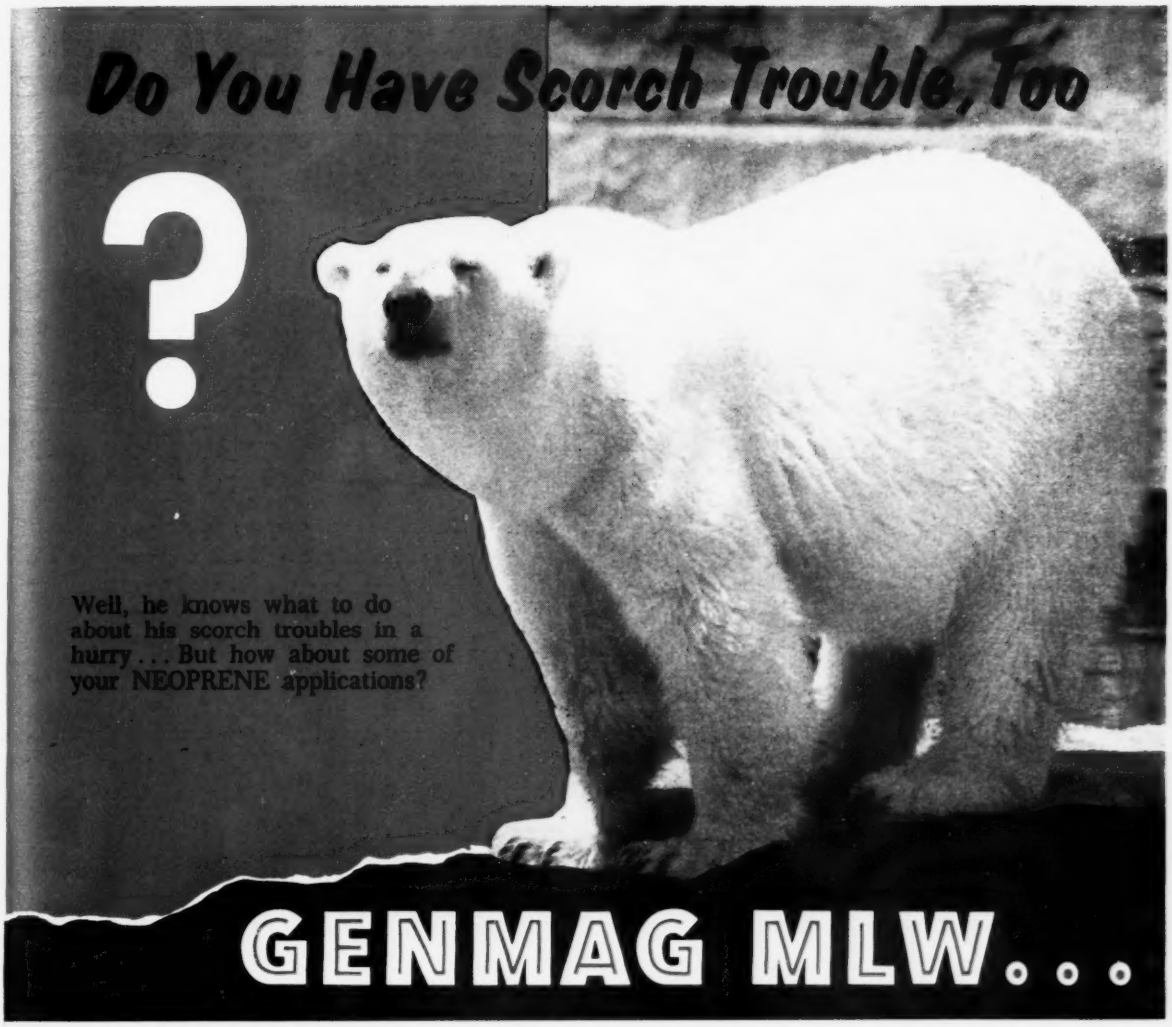

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GENMAG MLW is a magnesium oxide slightly denser than the extra light. It has been designed for Neoprene compounding of the most difficult type. It is white in color and has a fineness of 99.8% passing 325 sieve. It offers great scorch resistance and provides excellent cures . . . It is quite economical in price, too. GENMAG Medium Light Calcined Magnesia and Extra Light Calcined Magnesia offer high purity because they are low in manganese and free of chlorides. They are packed with special care to keep those purity properties and thus provide BETTER RESULTS.

Other Important Uses...

There are many important uses for these magnesias in improving products—in case-in cements, fluorescent tube coating, gas-tight cements, reagent for powdered oils, filler for artificial leather, dental compositions, textile sizings, plastics reactant and filler, etc.

1932 1957 25 YEARS OF SERVICE HARWICK STANDARD CHEMICAL CO.

Manufactured by General Magnesite and Magnesia Co.
Write for complete technical data.

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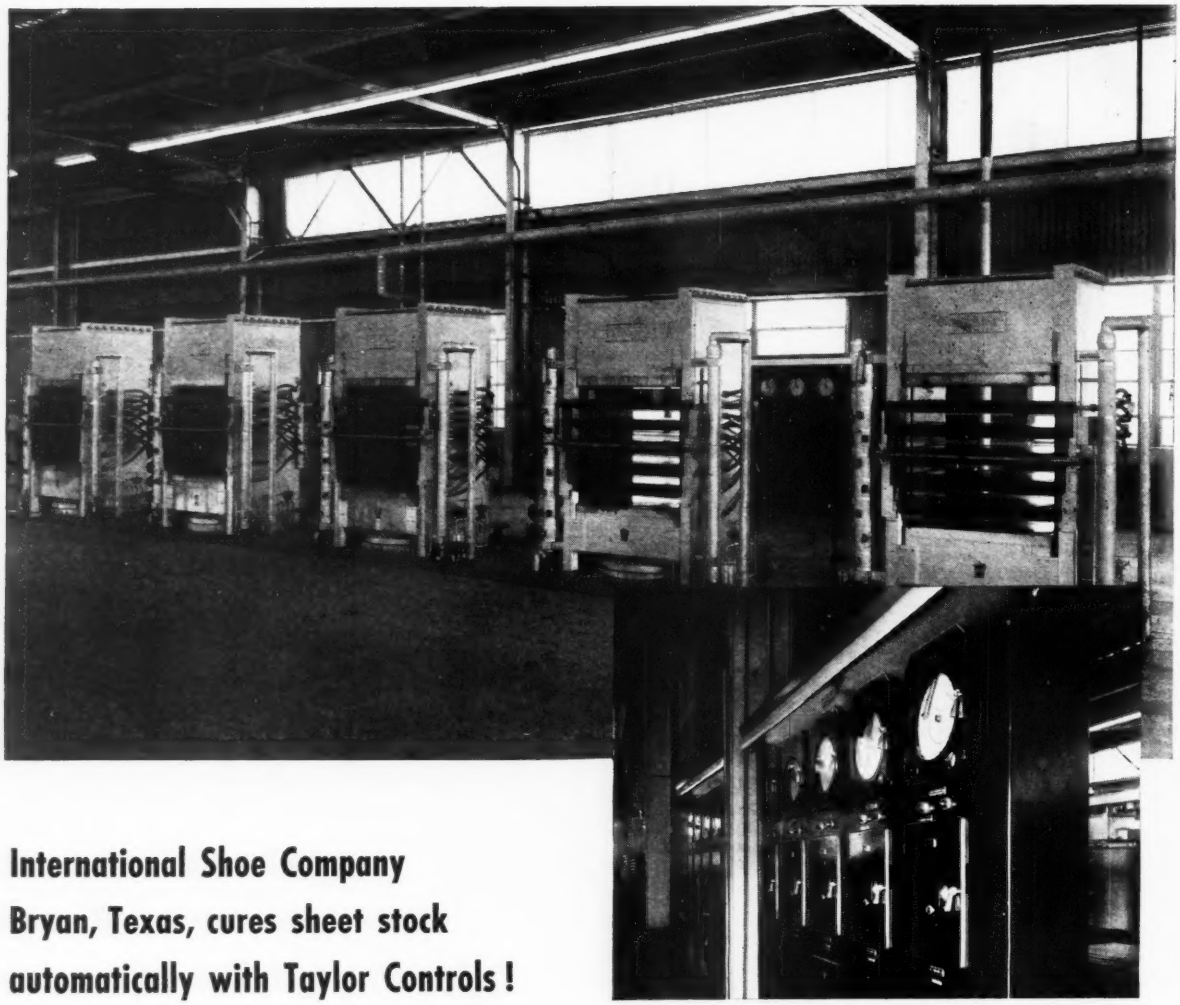
SOLE CONTROL



International Shoe Company Bryan, Texas, cures sheet stock automatically with Taylor Controls!

TAYLOR controls on their platen presses provide many benefits for the International Shoe Company.

1. **They protect International's fine name by insuring a uniformly high quality in their sheet stock.**
2. **Press performance is 100% predictable.**
3. **Since the entire sequence and duration of the cure is automatically controlled, production schedules can be set up so that the minimum number of operators can be used for the maximum number of presses. Skilled operators are thus released for other duties.**

The larger photograph above illustrates the battery of French Oil Mill Machinery Co. 42″ x 42″ platen presses, with one of the Taylor instrument panels in the background. Inset picture gives a close-up view of the control panel for ten 30″ x 30″ presses. The FULSCOPE* Controllers at top regulate platen temperature, while the FLEX-O-TIMER* Time Cycle Controllers automatically operate the presses, from closing them through bumping, timing the cure, operating the valves in proper sequence and opening of the presses.

*Reg. U.S. Pat. Off.

Note the "off-the-press" location of all instruments on central panels. This gives more convenient access to working areas and enables operators to check performance at a central point. Better "housekeeping" and care of equipment also results.

To find out how you can profitably put Taylor to work in your plant, call your Taylor Field Engineer, or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

"My Customer Found Cracks In Our 'New' Tires!"

Sales are lost, product acceptance damaged, when ozone cracking shows up even on new products.

You can give your product dependable protection from ozone cracking, from the day it's made till the day it's discarded even under the most extreme conditions, with Universal's high potency rubber antiozidants, UOP 288 and UOP 88.

To tires, or any other rubber product, natural or synthetic, these Universal antiozidants provide complete protection under both static and dynamic exposure.

To be sure your product presents the quality appearance you built into it, when it comes face to face with a potential customer, let us recommend the correct UOP antiozidant formulation to give it complete protection from ozone cracking.

UOP 88® and 288 TRADEMARK

RUBBER ANTIOZIDANTS

UOP®

PRODUCTS DEPARTMENT

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...with **DUREZ** phenolic **RESINS**

IN NITRILE COMPOUNDS. Completely compatible with Buna N, Durez resins disperse readily at low temperatures. The resin has excellent plasticizing action, contributes to vulcanization and abrasion-resistance, and to improved tensile strength, hardness, and resistance to heat and chemicals.

IN GR-S COMPOUNDS. These resins serve as plasticizers and even in moderate amounts, they produce hard, stiff, abrasion-resistant stocks that retain these properties under heat and load. Widely preferred for shoe sole and top lift stocks.

IN SOLVENT CEMENTS. Compatible and reactive with nitrile rubber, Durez resins afford close control of film reinforcement, hardness, and flexibility. In Neoprene solvent cements, these resins add film strength and provide control of solvent release with good adhesion to a variety of surfaces.

LET US HELP YOU. Send for our latest bulletin on Resins for the Rubber Industry.

DUREZ®

Phenolic Resins that Fit the Job

DUREZ PLASTICS DIVISION

HOOKER CHEMICALS PLASTICS

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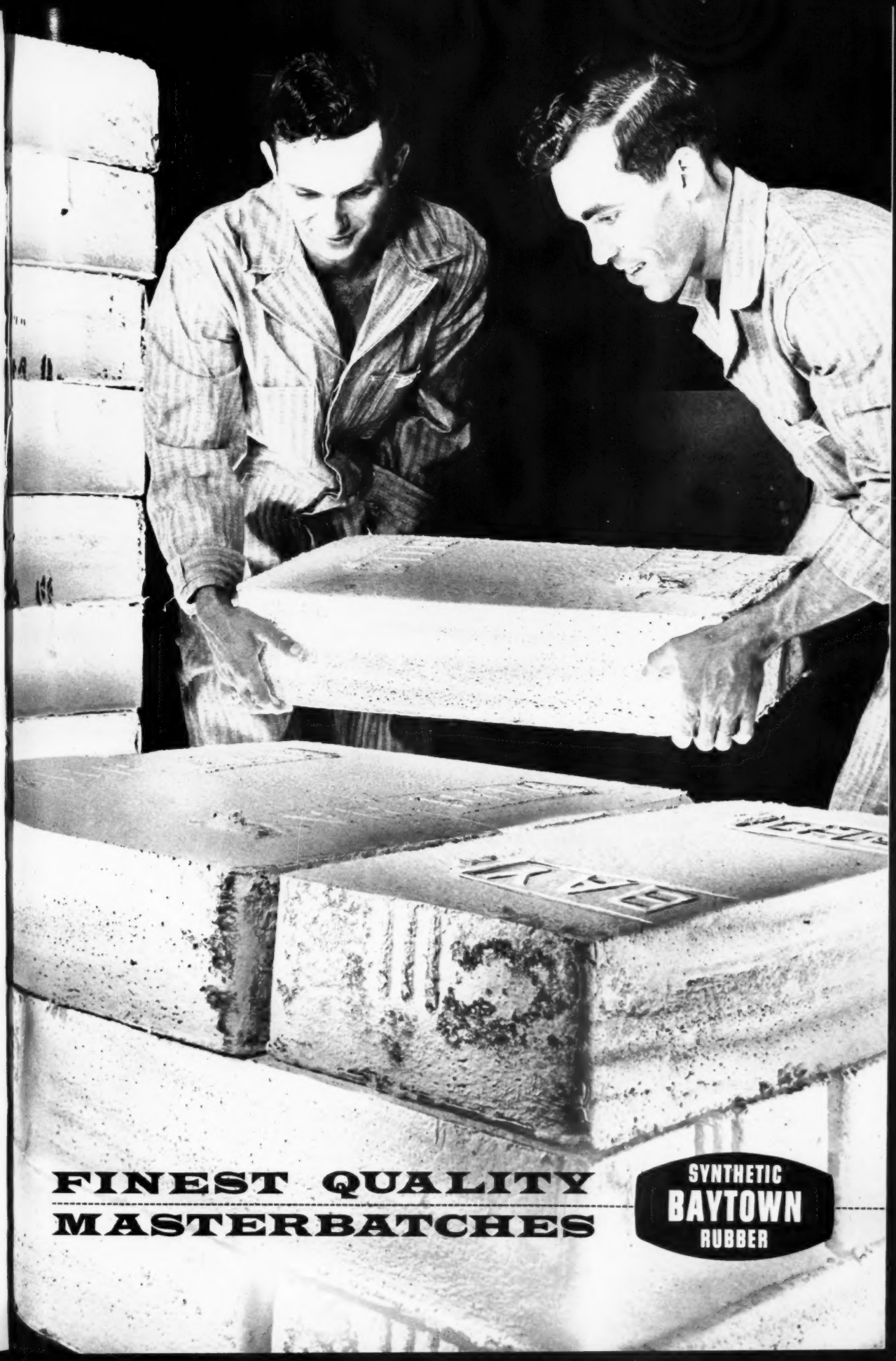
207 WALCK ROAD, NORTH TONAWANDA, N. Y.

Export Agent: Omni Products Corp., 460 Fourth Avenue, New York 16, New York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MASTERBATCHES
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RUBBER

Baytown Masterbatches symbolize the finest quality "cold" butadiene-styrene rubber with intimate dispersion of carbon black types of your choice.

Baytown Masterbatches are produced with unerring skill. They have an enviable record of uniformity unsurpassed by any other man-made rubber.

Baytown Masterbatches have wide applications — in quality tires, sturdy tread rubber, better grades of molded and extruded mechanicals, automotives, battery cases, etc.

Baytown Masterbatches give utmost satisfaction in processing and reinforcement. They simplify warehousing, materials handling and mixing. Of course, they are economical.

Baytown Masterbatches are the "black rubbers" of today and tomorrow. Standardize on them to excel.

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Another first from Monsanto

SANTONOX . . . a low-cost method for stabilizing polyethylene during processing . . . and reducing "greasiness" of finished product.

With as little as .02% Santonox mixed in the batch, extrusions are practically identical to die orifice.

Versatile though it is, the ubiquitous polyethylene polymer gives the processor certain worries . . . one of which is a lively instability during extruding, blowing, and—to a less degree—during molding. Major trouble is caused by the heat applied in the mixing, milling, and pressuring to shape. Heat causes cross-linking or scission in the molecule. Cross-linking creates a host of headaches: a reduction of flexibility; discoloration; lowered melt flow. But more painful than these to the processor extruding cable insulation, heat-induced cross-linking causes troublesome "swelling" as the polyethylene extrudes through the orifice and the composition develops a higher electrical-dissipation factor.

Chemically, the remedy was at hand: 4,4'-thiobis-(6-tert-butyl-m-cresol), highly purified, trade named Santonox. Some collaborative study quickly proved how well it *stabilizes* general-purpose and electrical-grade polyethylene against heat degradation.

So little does the trick! Just 0.03% on the weight of the polymer. Checked by ASTM Flow Measurement DI238-52T, the melt index remains constant for the full 45-minute heating. By "Percent-Recovery" test, after 45 minutes of milling, polyethylene with 0.03% Santonox shows only a 5% increase in the index over the unmilled resin. Two other commercial antioxidants tested in parallel show 102% and 83% increases at the same concentration. And even at 1%, these antioxidants permitted an increase in the Percent-Recovery of 18% and 30%, respectively. On the electrical properties side, polyethylene with a concentration of 0.05% Santonox retains virtually the *same dissipation factor after 2½ hours' milling.*

This little that does so much contributes something still more: the presence of 0.03-0.05% Santonox prevents exudation from the surface. Consequently, finished products are noticeably less "waxy" or greasy to the touch.

The finely crystalline Santonox can be added by either the polyethylene user or the manufacturer of the molding compound. It has been approved by the FDA up to a level of 0.05% in high-pressure polyethylene.

Monsanto's Rubber Chemicals Department will be glad to supply a test sample of Santonox or forward you the names of polyethylene producers whose compounds are supplied already stabilized. Write or call today.

Accelerators—For fast, slow, and regulated rates of safe cure

Antioxidants — For maximum oxidation resistance

Plasticizers

Specialty Processing Compounds

SANTONOX: Trademark of Monsanto Chemical Co.

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Rubber Chemicals Department
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MONSANTO®

ANNOU

Increased capacity ratings

THE Timken Roller Bearing Company announces an increase in the capacity ratings of most series of Timken® tapered roller bearings. Increases range up to 39%. Most are in the neighborhood of 10%. Some are negligible.

Permits Use of Smaller Bearings

This increase in capacity ratings makes it possible for many of you to use smaller bearings. Your products can be made more compact. You can save weight. You may be able to reduce the size of your shafts and housings. And you may be able to use Timken bearings in new applications where they have not been practicable in the past.

3 Reasons for Increases

What led to these increases in Timken bearing capacities? Three things: First, a careful review of more than 6,000 different laboratory studies

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

NCING!

for Timken® bearings

of Timken bearing performance on fatigue life machines. From these exhaustive studies, conducted on an organized, scientific basis since 1924, we keep learning more and more about predicting bearing life.

Second, refinement in the method of analyzing these studies mathematically.

Third, a careful review of the life of millions of Timken bearings in the field.

How Much Can This Save *YOU?*

To find out how the new capacity ratings affect the types and sizes of Timken bearings in which you are interested, call your Timken bearing representative or write our Engineering Department. We'll be glad to work with you at the drawing board stage. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TAPERED ROLLER BEARINGS ROLL THE LOAD

LOOK TO GLIDDEN PIGMENTS!

White products stay white longer when they contain Glidden *Zopaque* Titanium Dioxide. It's the *whitest* white pigment obtainable!

That's why Airflex® white soles by Bearfoot Sole Co., Inc., Wadsworth, Ohio, can easily be restored to their original extreme whiteness even after many months of hardest wear. *Zopaque* helps them take soil and scuffing in stride—at work or play, in all kinds of weather.

Chances are Glidden *Zopaque* Titanium Dioxide can help give greater lasting whiteness to the white products you manufacture, whether paint, rubber, plastic, paper or ceramic. With greatly expanded production facilities, Glidden can now supply your complete white-pigment needs. Write today for full details.

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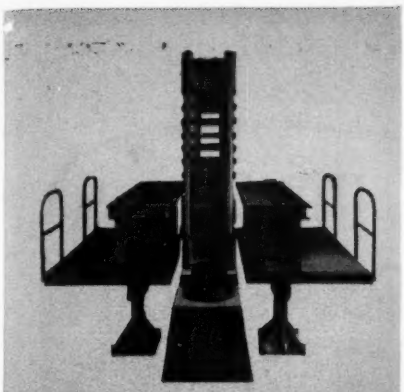
CHEMICALS PIGMENTS METALS

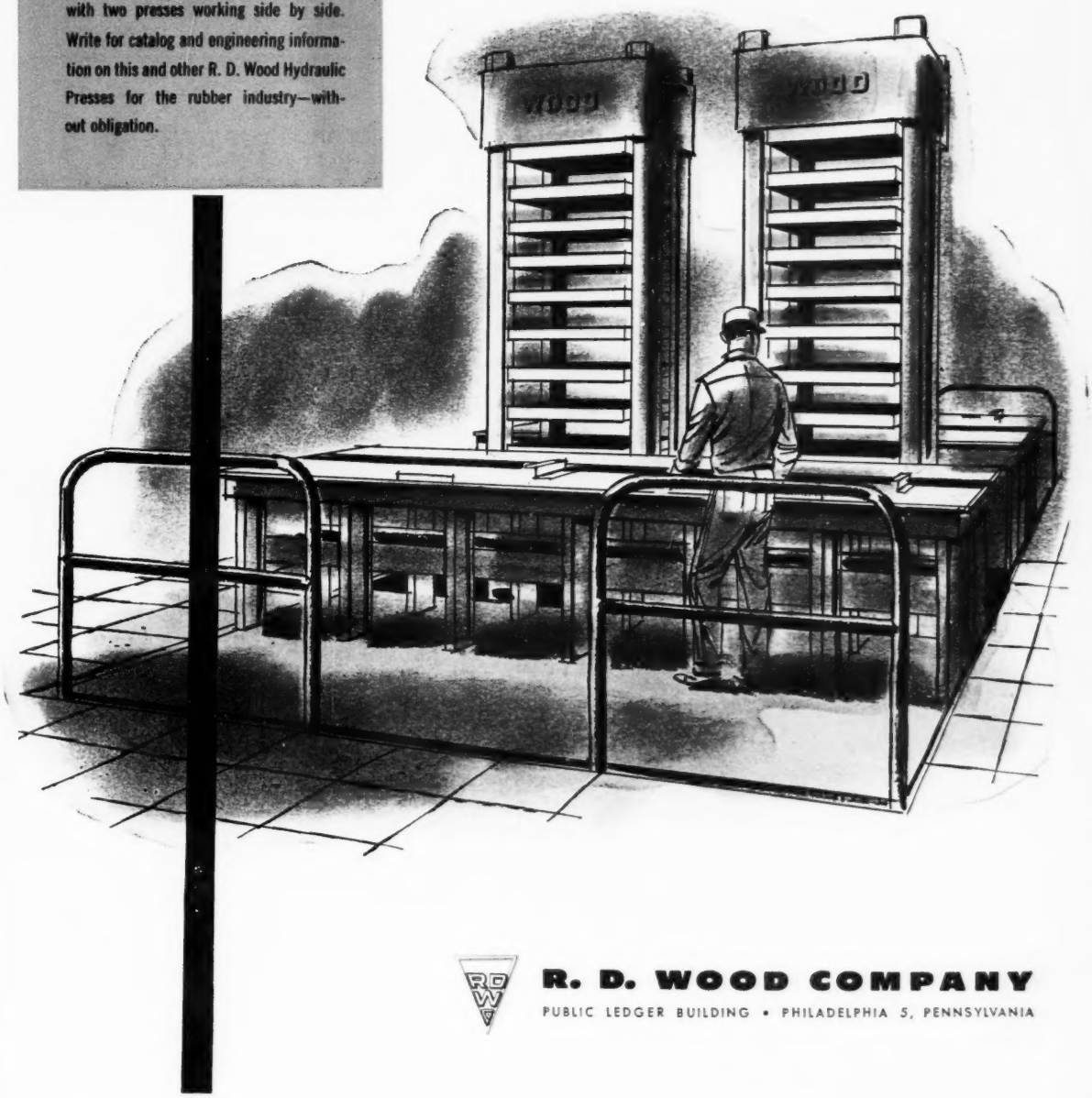
QUALITY Glidden PRODUCTS



192-ton Multiple Opening Platen Press. Designed for molding rubber products. This press may be operated from an individual self-contained pumping unit or a central accumulator system. Two elevators operate with two presses working side by side. Write for catalog and engineering information on this and other R. D. Wood Hydraulic Presses for the rubber industry—without obligation.

The most productive plants use R. D. Wood Presses

For proof, look at production records—and downtime for maintenance. Then watch an R. D. Wood Press at work. See for yourself the smooth, precise operation—the dependable performance—even under tough conditions. Finally, inspect an R. D. Wood Press up close. Notice the soundness of design, the excellence of materials, the scrupulous care given to each detail of construction. These are the reasons why R. D. Wood Presses have been the standard of excellence throughout the rubber industry.



R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING • PHILADELPHIA 5, PENNSYLVANIA

AGENT 36

SILICONE SQUAD

HOW I SOLVED THE SCRAP CAPER

FROM THE OFFICIAL FILES OF DOW CORNING

GOO, YOU'RE THROUGH. YOU'VE PULLED YOUR LAST STICK UP!
OPEN THE MOLD RICHARD!
BRRACK! YOU'LL NEVER GET ME GUM-SHOO!
AGENT 36
5
NO, NO, PLEASE... NO, NOT DOW CORNING SILICONES... NO... OH NO!... ARGHH!
TAKE THAT! AND THAT!
AGENT 36
6
NOW SCRUB HIS (UGH!) DIRTY REMAINS OUT OF THE MOLD.
AGENT 36
7
THAT FINISHES STU GOO, AND YOUR SCRAP TROUBLES, TOO. YOUR MOLDS WILL NEVER GUNK UP WHEN THEY'RE LUBRICATED WITH DOW CORNING 36 EMULSION.
AGENT 36
8
DOW CORNING 36 GIVES QUICK RELEASE, REDUCES SCRAP, IMPROVES SURFACE FINISH, STEPS UP PRODUCTION, CUTS MOLD MAINTENANCE, SAVES MONEY, MAKES EVERYBODY HAPPY!
AGENT 36
DOW CORNING 36
9
YOU CAN'T FIND A BETTER RELEASE AGENT THAN 36 EMULSION. GET YOUR FACTS. DOW CORNING'S THE SOURCE. DO IT NOW!
first in silicones
Dow Corning CORPORATION
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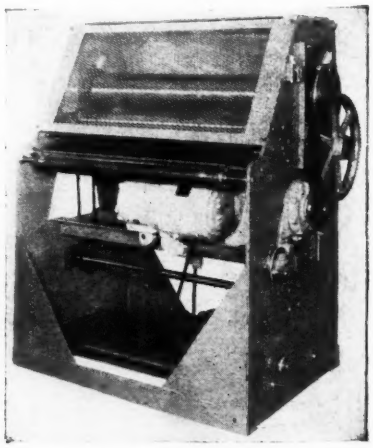
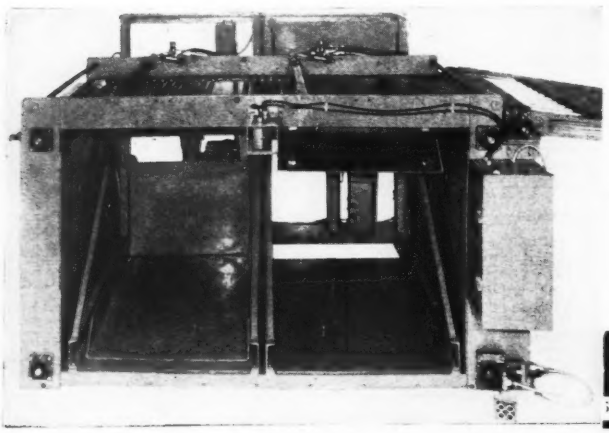
NEW... ALFA AUTOMATIC CUTTING and STACKING UNITS

- Cut and stack at speeds up to and in excess of 100 f/m.
- Material widths 24" to 50".
- Length of cut 24" to 60".
- Both units readily synchronized to processing lines.
- Maximum stack height 40"—maximum stack load 4,000 lbs. per skid.
- Easy removal of skids without stopping continuous production.
- Machines can be used individually or combined to form complete cutting and stacking unit.





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FOR MILLED • EXTRUDED • CALENDERED STOCKS • SOLING • TILING • ETC.

SPADONE MACHINE CO. INC.

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THE STAMFORD RUBBER SUPPLY CO.
Vulcanized Oil

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OLDEST AND LARGEST MANUFACTURERS OF *Factice* VULCANIZED OIL SINCE 1900

LEADERS IN THE FIELD For RESEARCH and MANUFACTURING DEPENDABILITY

THE STAMFORD RUBBER SUPPLY COMPANY, STAMFORD, CONN.

COPO

means uniformity in cold rubber...

. . . and to help you cut figure eights, or any other figures for that matter,
from your production costs, you must start with
UNIFORM RAW MATERIALS.

pioneering • good service • well-packaged • high quality

COPOLYMER RUBBER & CHEMICAL CORPORATION • BATON ROUGE 1, LOUISIANA COPOLYMER CRCC COLD RUBBER SPECIALISTS

HARFLEX® 300

PERMITS A FREE FLOWING DRY BLEND

In a typical test, 64 parts of HARFLEX® 300, preheated to 212°F, were mixed with 100 parts of an easy-processing polyvinyl chloride resin at 212°F. After 30 minutes of thorough agitation, a dry, free flowing powder was obtained which could be put directly into an extruder. When a free flowing dry blend is used directly, as in extrusion operations, it is possible to eliminate or minimize extra operations such as Banbury mixing or roll milling.

HARFLEX® 300 is a permanent polymeric plasticizer, readily adaptable to dry blending. Write for our free technical bulletin that gives full information about HARFLEX® 300. Samples for your test or experimental work are also available at your request.

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H-21-R

KEEP YOUR BANBURY® MIXER RUNNING SMOOTHLY

with regular visits from a factory-trained specialist

Any one of these five Farrel-Birmingham service engineers is a good man to get acquainted with. He knows your Banbury mixer and its characteristics... what it can do... what makes it tick... or keeps it ticking... what (if anything) is wrong and how it can be cured quickly, correctly.

His knowledge is based on years of factory training and a storehouse of "know-how" developed through contacts with industry. Further, he's backed by the original manufacturer of the Banbury mixer—Farrel-Birmingham. As a result, he is able to recommend research-improved parts and materials—give you rebuilding that assures new Banbury performance.

The Farrel-Birmingham specialist is a regular and welcome visitor in hundreds of plants. They rely on him for expert advice on rebuilding problems, mixing practice, and related equipment built by the company. And, they often arrange, through him, for "Planned Banbury Downtime"—thus eliminating the possibility of trouble at a critical production period.

Call and arrange for no-charge visits from an F-B specialist.

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WALTER D. TAYLOR—1929: joined company. Served 5 years as machinist apprentice; 5 years as machinist; one year on gear drives. 1941: transferred to sales and service. 1945: made senior sales engineer. Presently manager of field service.

RICHARD E. BAKER, JR.—1937: came to Farrel-Birmingham from Ford Motor Company as skilled machine assembler. Erector for ten years, last two as group leader. 1946: transferred to Banbury division as sales-service engineer.

GEORGE WILSON—1940: joined Farrel-Birmingham as learner. Made machine assembler following year. 1943-55: machinery installation in customers' plants. 1955: transferred to Banbury division as sales-service engineer.

ALFRED W. MARSCH—1940-44: Farrel-Birmingham apprentice. 1944-46: U. S. Army—returned to company as machine erector. 1954: transferred to Akron as sales-service engineer.

EDWARD H. SHORTELL—1941: started as learner-erector. Became machine assembler same year. 1945: made erector of machinery—has handled large installations in customers' plants. 1955: transferred to Chicago as sales-service engineer.

FB-1121

KO-BLEND . . .
the best way known
to assure
flawless whitewalls

In white sidewall stock,

KO-BLEND

is your protection against

- SULFUR BLOOM
- POOR SULFUR DISPERSION
- MOLDING DEFECTS

For less than ½¢ per whitewall tire you can add the small amount of Ko-Blend necessary to reduce rejects and reworks to a minimum. Ko-Blend is a latex-compounded masterbatch containing 85% insoluble sulfur which has been colloidally dispersed in GRS latex.

The extremely short milling time necessary to incorporate Ko-Blend makes it possible to maintain high Mooney viscosity in whitewall stocks while overcoming processing difficulties encountered when other types of sulfur are used. For samples and further information on how Ko-Blend eliminates spots, streaks and batch softening, write to:

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Chemical Division
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Creating Progress Through Chemistry

Chemical Division GENERAL
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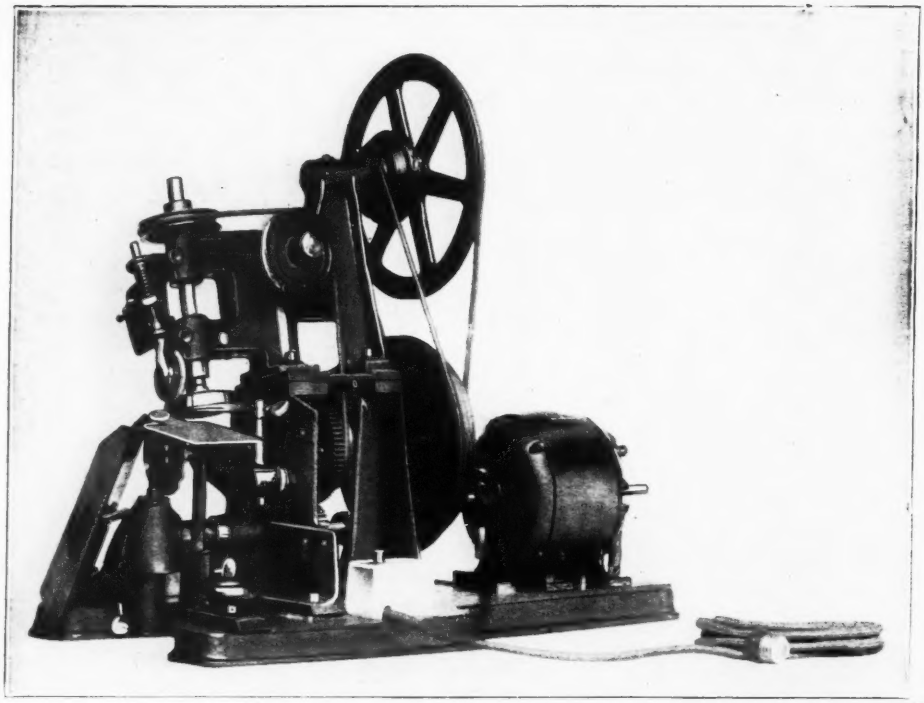
TW MORRIS TRIMMING MACHINES

The World's Trimmers



SEMI-AUTOMATIC HEEL AND SOLE TRIMMER #20

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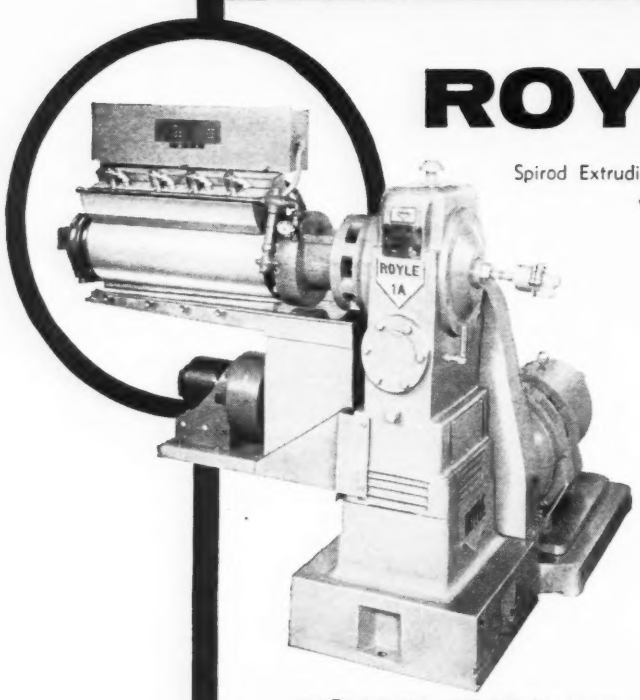
CABLE "MORTRIM"

ROYLE 1A (2½" cylinder bore)



Spirod Extruding Machine with electric heating and high velocity evaporative cooling. An all-purpose extruding machine for processing rubber and plastics.
Available in sizes 1⅛" through 12" cylinder bore.

Strainers, Cooling Troughs, Light Wire and Cable Capstans, Motorized Take-ups, Temperature Control Units.

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BUILD THE PATTERN OF A TIRE TREAD

Tire tread designs are patterns with a purpose. Years of research by the tire industry has proven every slot, every angle to be the most efficient . . . to offer the most in road holding with a minimum of wear. This is no small contribution to safer, surer transportation.

Those thousands of thin grooves are difficult to make . . . still, they provide the "biting edge" for safe stops. Molded in standard equipment with extremely thin section molds, the grooves are made possible because of the easy release properties of UNION CARBIDE Silicones. And, production is increased, rejects are reduced. One manufacturer, after eight years of experience, states: "Silicones reduce blemishes on treads, permit complicated treads not possible without silicones, and eliminates mold cleaning."

This is another example of how the UNION CARBIDE Silicones Man has helped solve an "impossible" problem . . . why UNION CARBIDE is one of the leading suppliers of silicone release agents for the rubber industry. For details, contact our distributor, C. P. Hall Co., with offices in Newark, N. J., Chicago, Ill., Akron, Ohio, Memphis, Tenn., and Los Angeles, Calif., or write Dept. RW - Silicones Division, Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y.

UNION CARBIDE TRADE-MARK SILICONES

The term "UNION CARBIDE" is a trade-mark of UCC.

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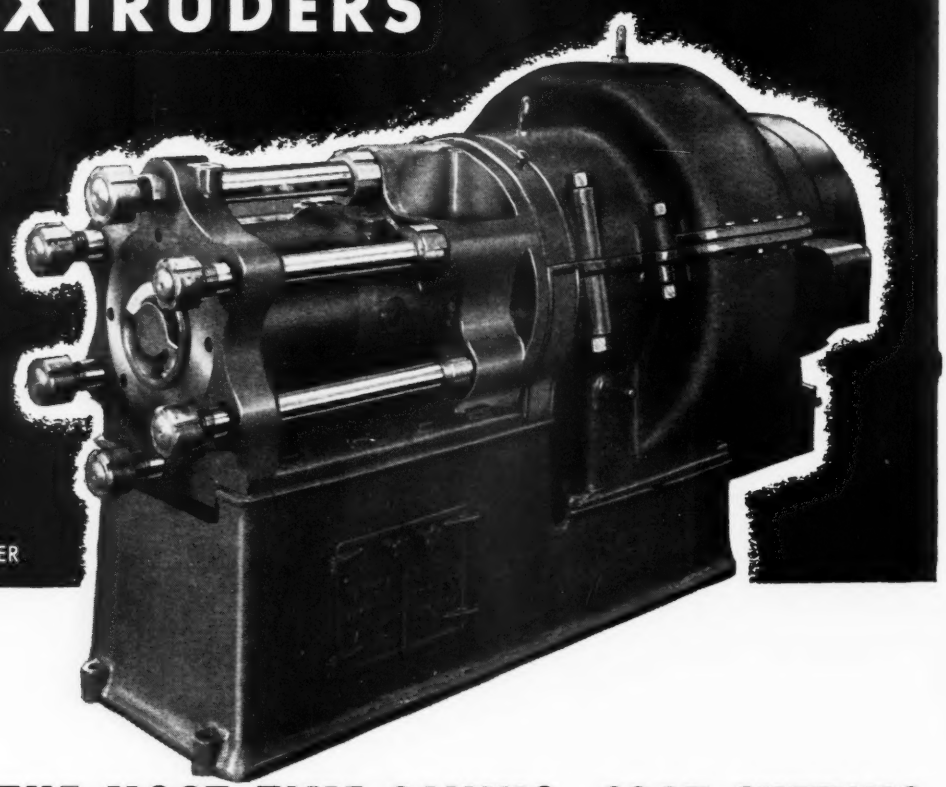
4 big advantages make NRM Rubber EXTRUDERS



NRM 10"
RUBBER EXTRUDER

...THE MOST TIME-SAVING, COST-CUTTING MACHINES IN THE INDUSTRY:

- LOW INITIAL COST
- LOW MAINTENANCE
- HIGH PRODUCTION
- L-O-N-G LIFE

2691

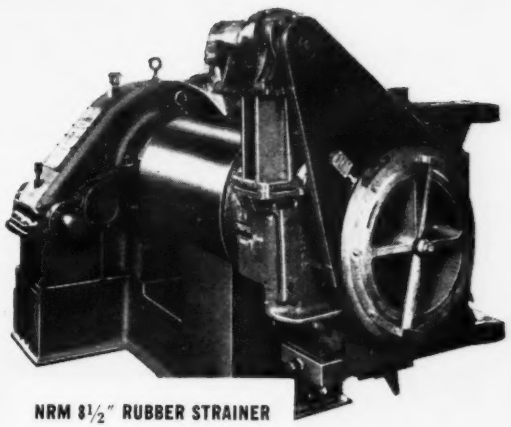
THE NRM RUBBER EXTRUDERS shown here are representative of the **full line** available to the industry in sizes from 1½" to 12". Larger Extruders to meet special requirements are produced on order. While many advanced design and construction features contribute to the four **big** advantages of NRM Rubber Extruders, the following are of special importance:

SIMPLICITY — Practical, uncomplicated design makes NRM Extruders extremely dependable and easy to operate. Compact construction makes them space-saving.

VERSATILITY — A variety of die heads make possible tube, tread, slab and other types of extrusions with a single machine, further increasing the production range of NRM Extruders.

DURABILITY — NRM Extruders are built to "stand the gaff" of mechanical rubber goods production . . . oversize thrust and radial bearings, heavy heat-treated steel cut herringbone gears, corrosion-resistant cylinder liners and hardened surface feed screws are a few of the heavy-duty construction features that assure a long life of high production at minimum cost for maintenance.

It's easy to spend more for a rubber extruder than the low first cost of an NRM, but difficult to equal the NRM quality features that help manufacturers increase profit on rubber goods production. If you are planning to purchase rubber extruders, contact us. We'll be happy to assist you in your planning, and recommend the type and size NRM Extruders to meet your requirements most efficiently and economically.



NRM 8½" RUBBER STRAINER

Quick-opening air-operated die heads, hinged strainer plates, undercut feed boxes . . . save time, cut costs in stock preparation.

NRM 4½" MIL-X-TRUDER®

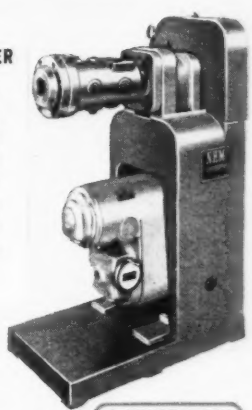
Turns warm-up time to production time by eliminating the need of a warm-up mill. Uses either extended smooth-bore, or fluted cylinder liners. Ideal for extruding Silicone compounds.

Write for these NRM Bulletins

- RUBBER EXTRUDERS
- MIL-X-TRUDERS
- RUBBER STRAINERS
- MIL-STRAINERS
- EXTRUDER DIE HEADS

NRM 1½" RUBBER EXTRUDER

Never an idle moment for this machine . . . when not in laboratory work, it pays its way in actual production of small cross-sections. Materials, design and construction are the quality equal of any big NRM Extruder.



2691

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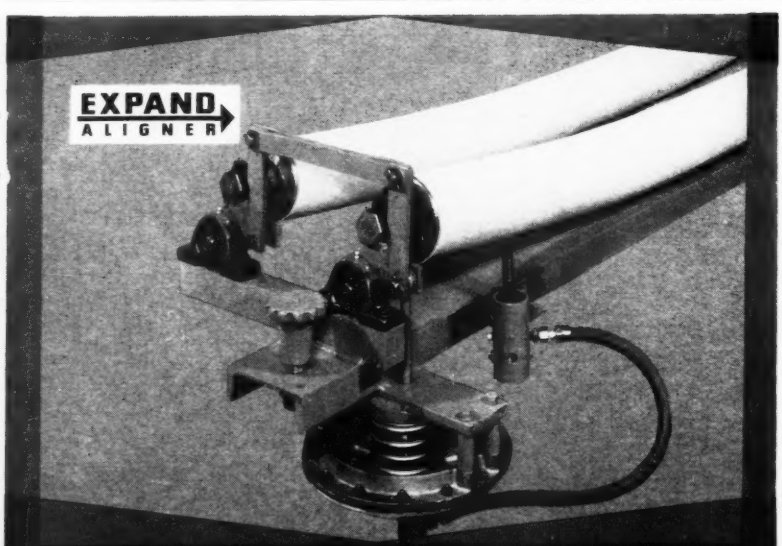

ROLL CAMBER ADJUSTED BY FABRIC EDGE GAGE FOR PRECISE CONTROL OF WIDTH, CENTERING AND EDGE CONDITION OF TIRE FABRICS AND OTHER OPEN WEAVES DURING WEB PROCESSING . . . *Bulletin on Request*

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New improved 1703, 1707 and 1708 SYNPOLS meet with unprecedented acceptance in less than 3 months!

Though offered to TEXUS customers less than three months ago, the new 1703, 1707 and 1708 SYNPOLS have already been adopted for all existing uses of these polymer types.

The reasons? These new TEXUS SYNPOLS proved to be 100% interchangeable... number for number... with previously used dark-colored, oil-extended rubbers of the same types. They also answered the need for light-colored rubbers extended with an oil which is non-volatile at the high temperatures experienced in modern high-speed mixing equipment.

Resulting from the development of a new, non-volatile pale naphthenic oil used exclusively in TEXUS SYNPOLS, these improved polymers offer the technical advantages of:

HIGH PHYSICALS—important in regular and cellular shoe soles;

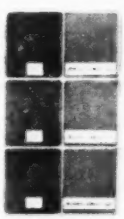
BRIGHT AND LIGHT COLORS WITH ECONOMY—an obvious must in the manufacture of floor tile, toys, molded household goods and products requiring a high degree of transparency;

LOW WATER ABSORPTION*—resistance to water absorption is a vital consideration in such products as athletic equipment, industrial rollers and various types of mechanical goods;

EASE OF PROCESSING—necessary in smooth-finish calendered products such as waterproof sheeting.

(Technical data available on request.)

Extensive factory tests and current use of the new 1703, 1707 and 1708 SYNPOLS in product manufacture by present TEXUS customers eliminate your need of extensive testing when adopting these light-colored polymers for your present product line. In addition, the outstanding characteristics of these improved SYNPOLS now offer exciting possibilities for your new product development. Call on TEXUS Technical Service for complete assistance.



THE CASE FOR SYNPOLS

This convincing comparison case shows the new 1703, 1707 and 1708 SYNPOLS side by side with dark rubbers of the same numbers. Your TEXUS representative would like the opportunity to show it to you and, at the same time, give you complete information on the entire line of TEXUS SYNPOLS. It's easy to find out how your product line can benefit from these new developments by TEXUS—just write, wire or phone today.

*SYNPOL 1708 has low ash content and water absorption values similar to those formerly found only in premium priced rubbers.

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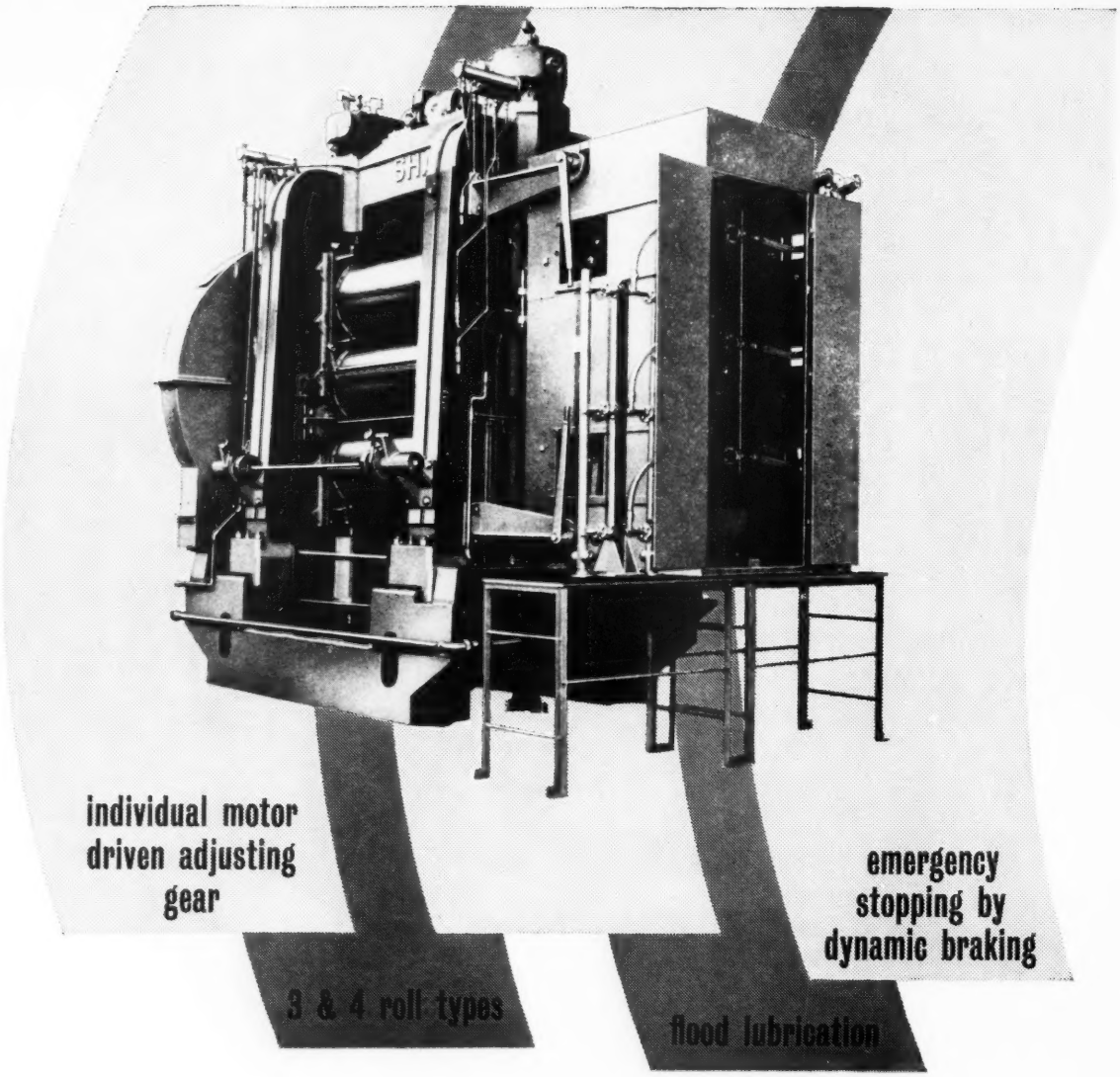

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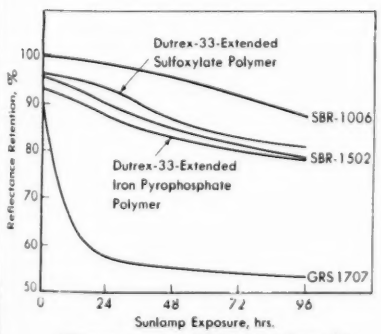
Color stability of TiO_2-loaded, Dutrex 33-extended SBR stocks after severe exposure to artificial sunlight.

Sample designation—reading clockwise

1707—GRS-1707
Dutrex 33—SBR-37.5 phr Dutrex 33-extended iron pyrophosphate polymer
1502—SBR-1502
Dutrex 33—SBR-37.5 phr Dutrex 33-extended sulfoxylate polymer
1006—SBR-1006

Non-staining extending oil

for light-colored rubber stocks



Whiteness retention of TiO_2-loaded, Dutrex 33-extended SBR stocks. (Reflectance retention compared to unexposed S-1006 control.)

Shell Dutrex® 33 is a superior naphthenic extender for SBR combining extremely light color and outstanding color stability with good compatibility and low volatility. This attractive balance of properties now provides practical oil-extended SBR stocks with staining and discoloration resistance approaching the best oil-free SBR types.

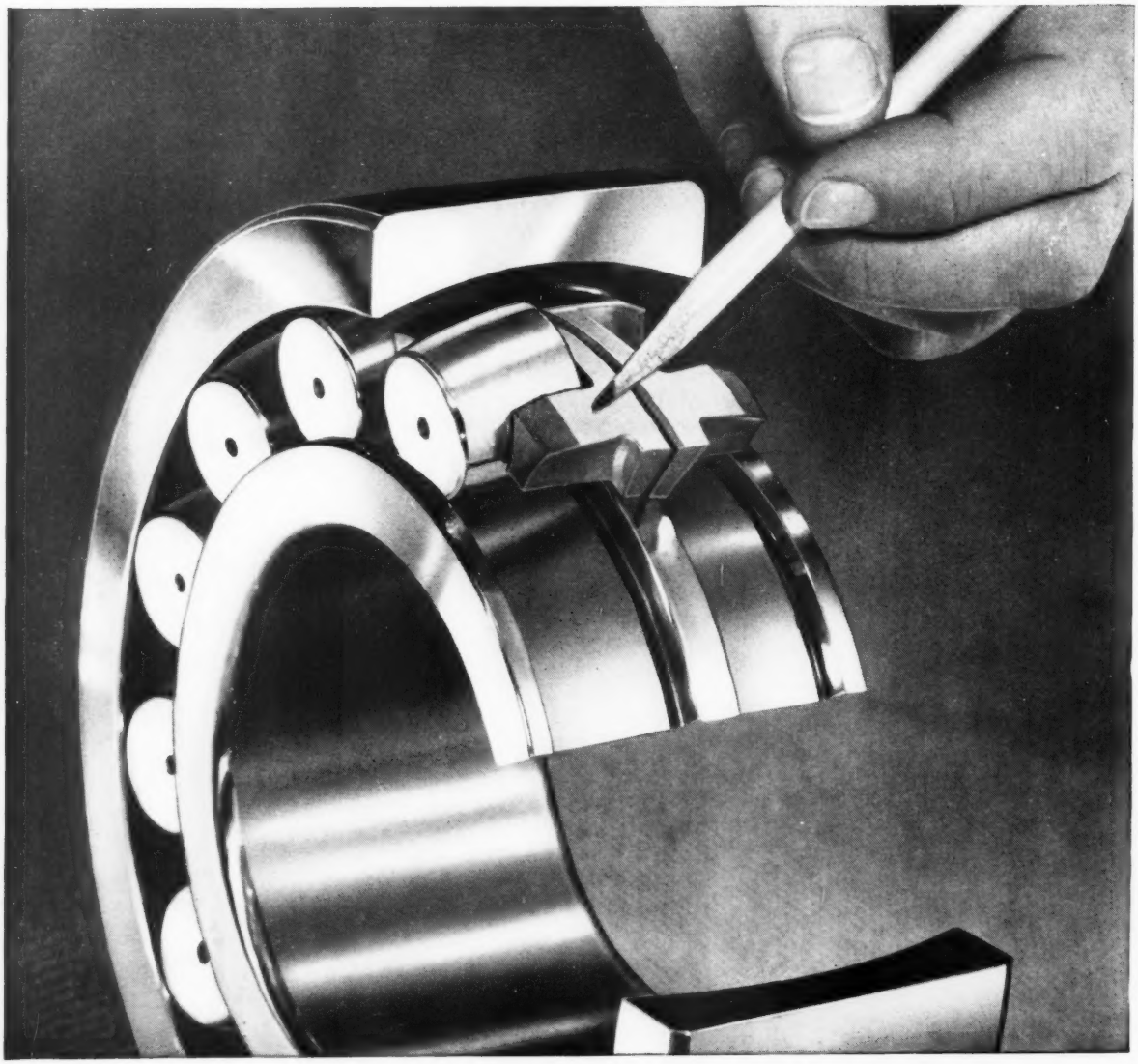
The outstanding resistance of Dutrex 33-extended SBR stocks to discoloration by severe sun lamp exposure is shown in the accompanying illustrations. Results indicate that Dutrex 33-extended SBR may serve in some applications where critical discoloration and contact or migration staining resistance have previously demanded use of oil-free types.

For additional information, write or call Shell Oil Company, 50 West 50th Street, New York 20, N. Y., or 100 Bush Street, San Francisco 6, California.

SHELL

SHELL DUTREX 33

TORRINGTON *SPHERICAL ROLLER* BEARINGS



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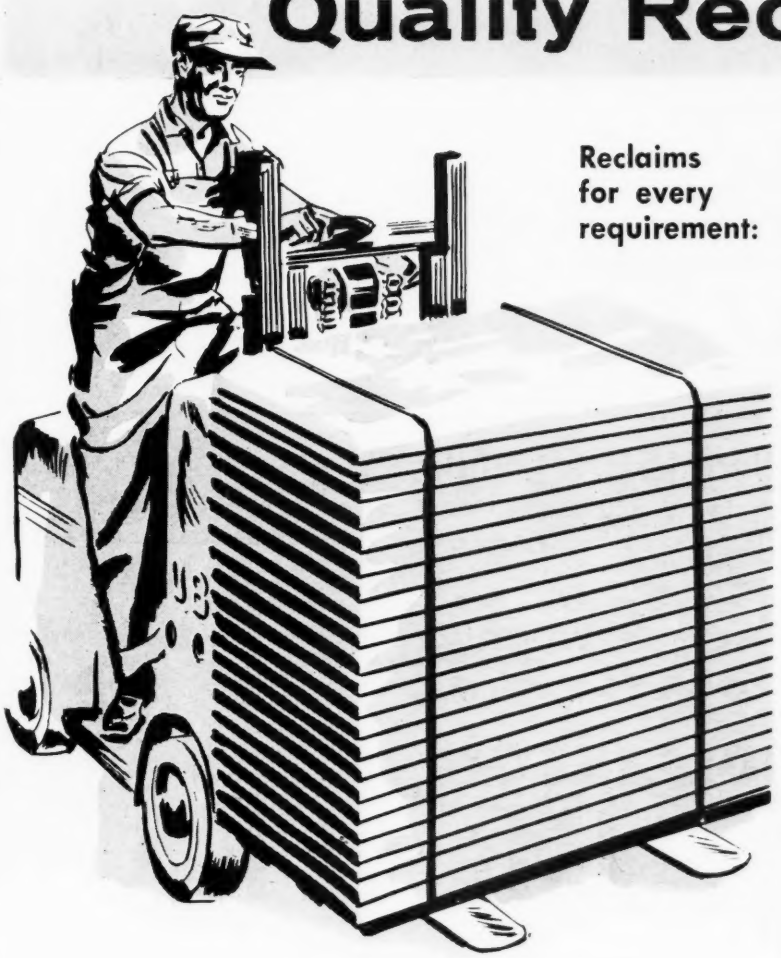

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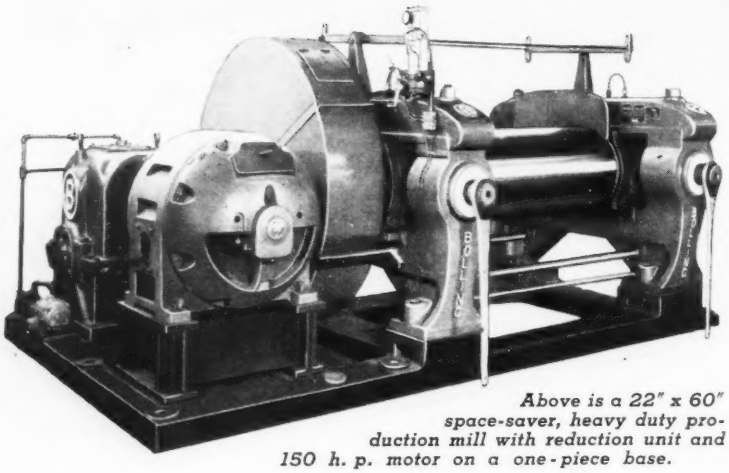

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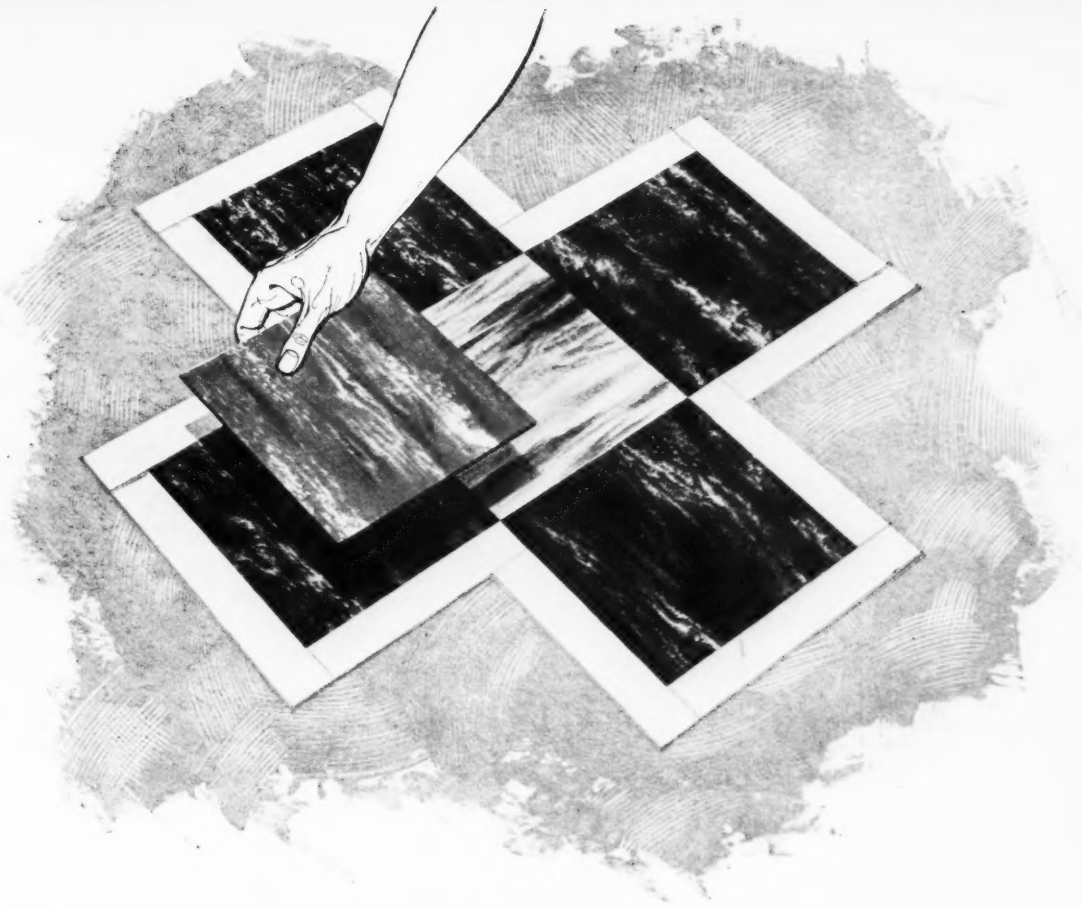

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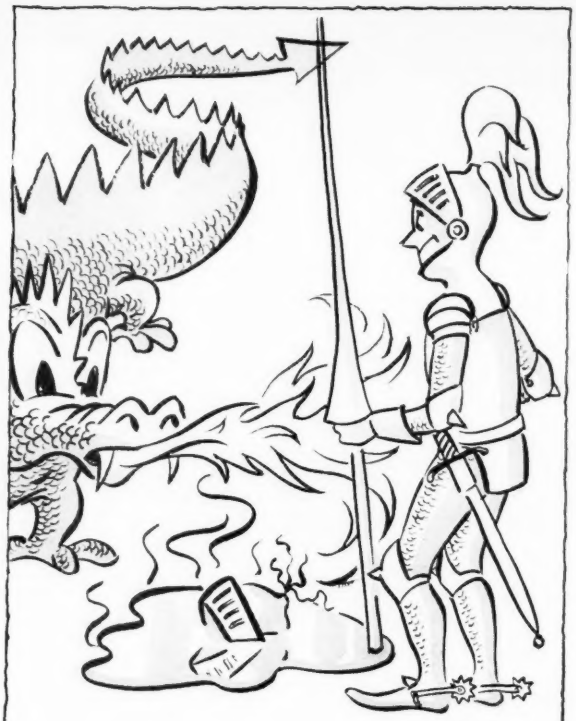

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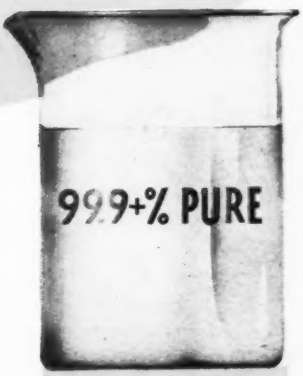

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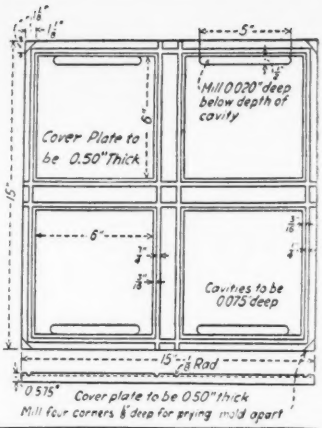
5"
Mill 0.020" deep below depth of cavity
Cover Plate to be 0.50" Thick
6"
Cavities to be 0.075 deep
15"
0.515" Cover plate to be 0.50" thick
Mill four corners ⅛ deep for prying mold apart

SLAB→ MOLD D15-41

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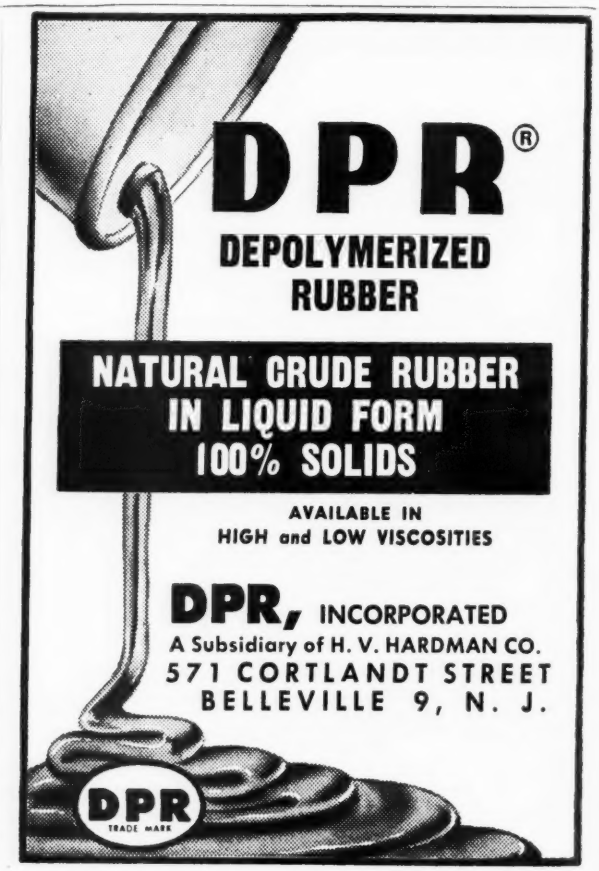

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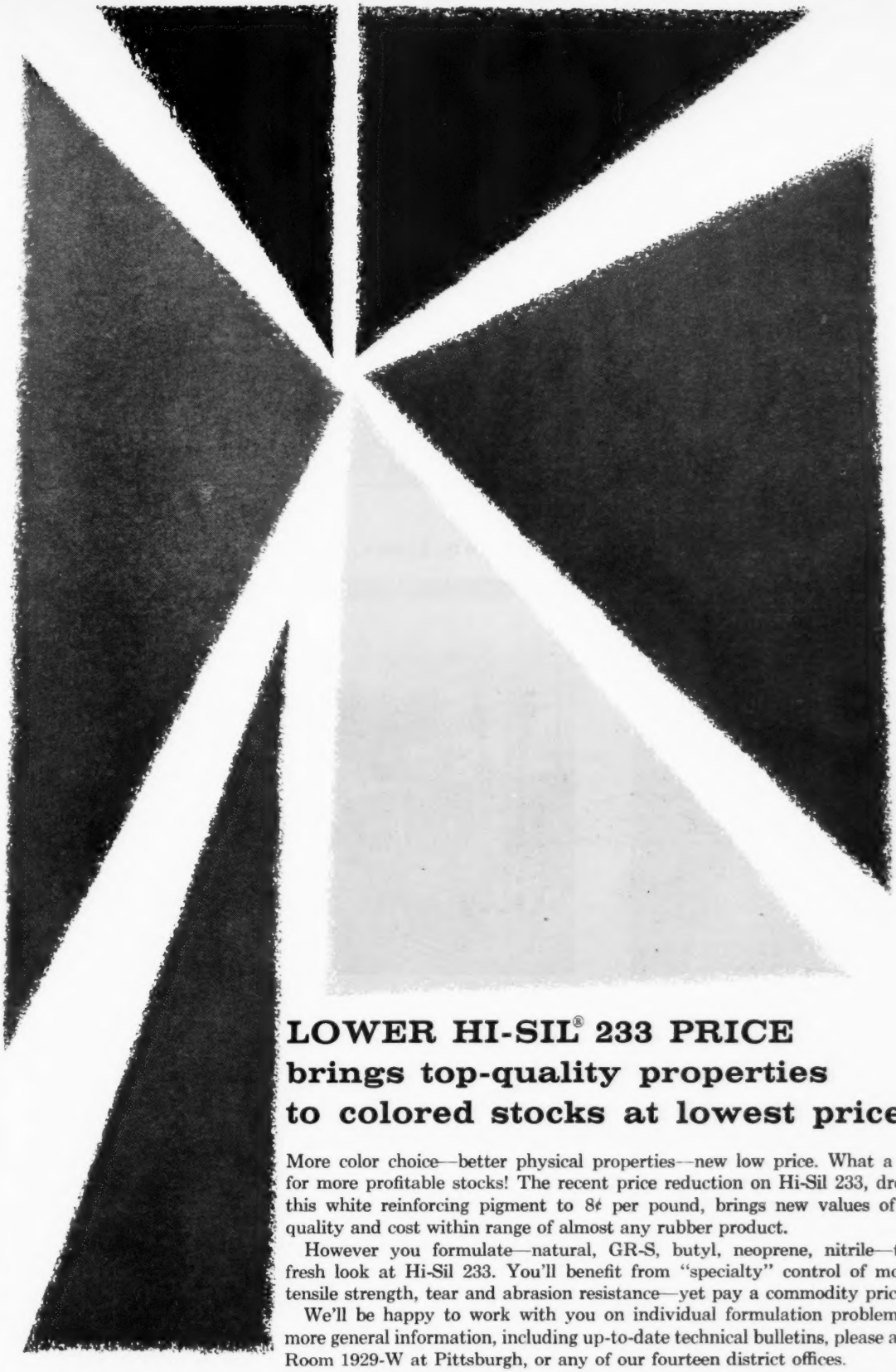

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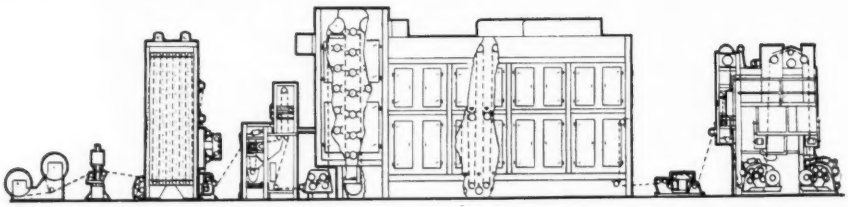

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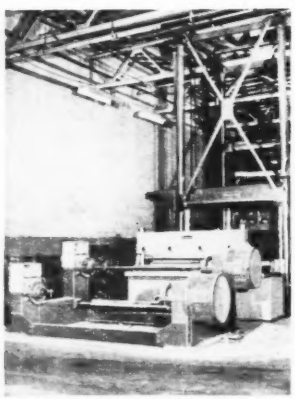
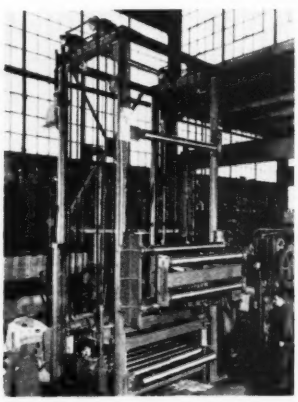
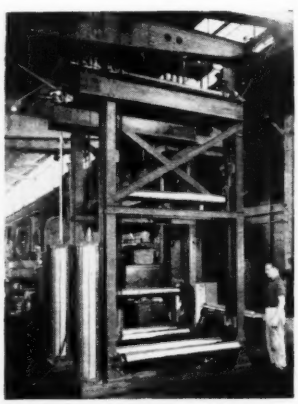


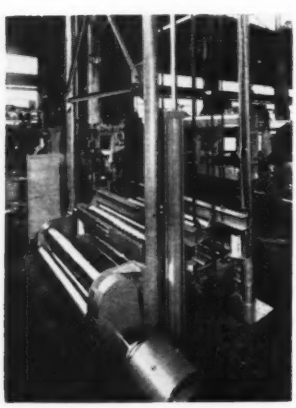
Dual Fabric Letoff



Accumulator & Fabric Guide Assembly



Compensators



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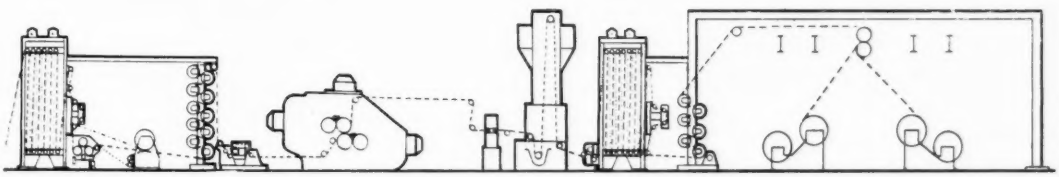

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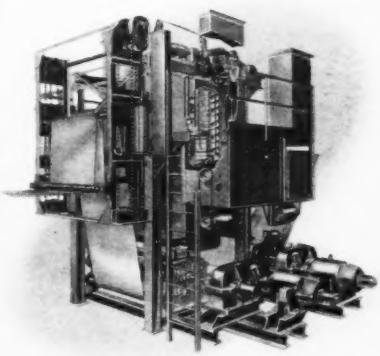
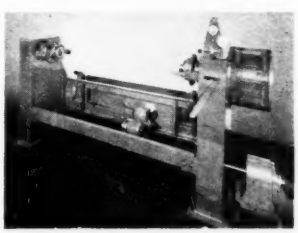
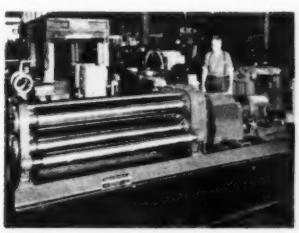


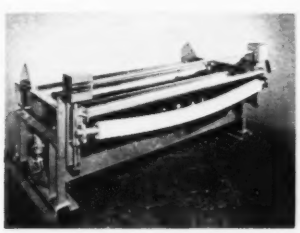
Nylon Hot-Setting Machine



Combination Windup & Letoff



Tension Roll Stand



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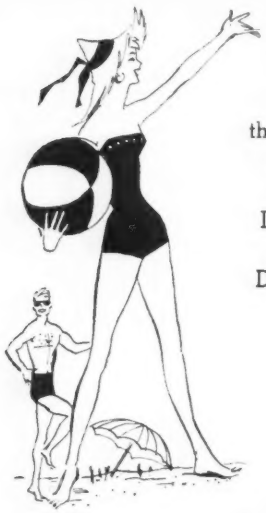

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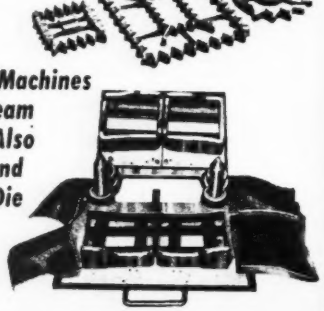

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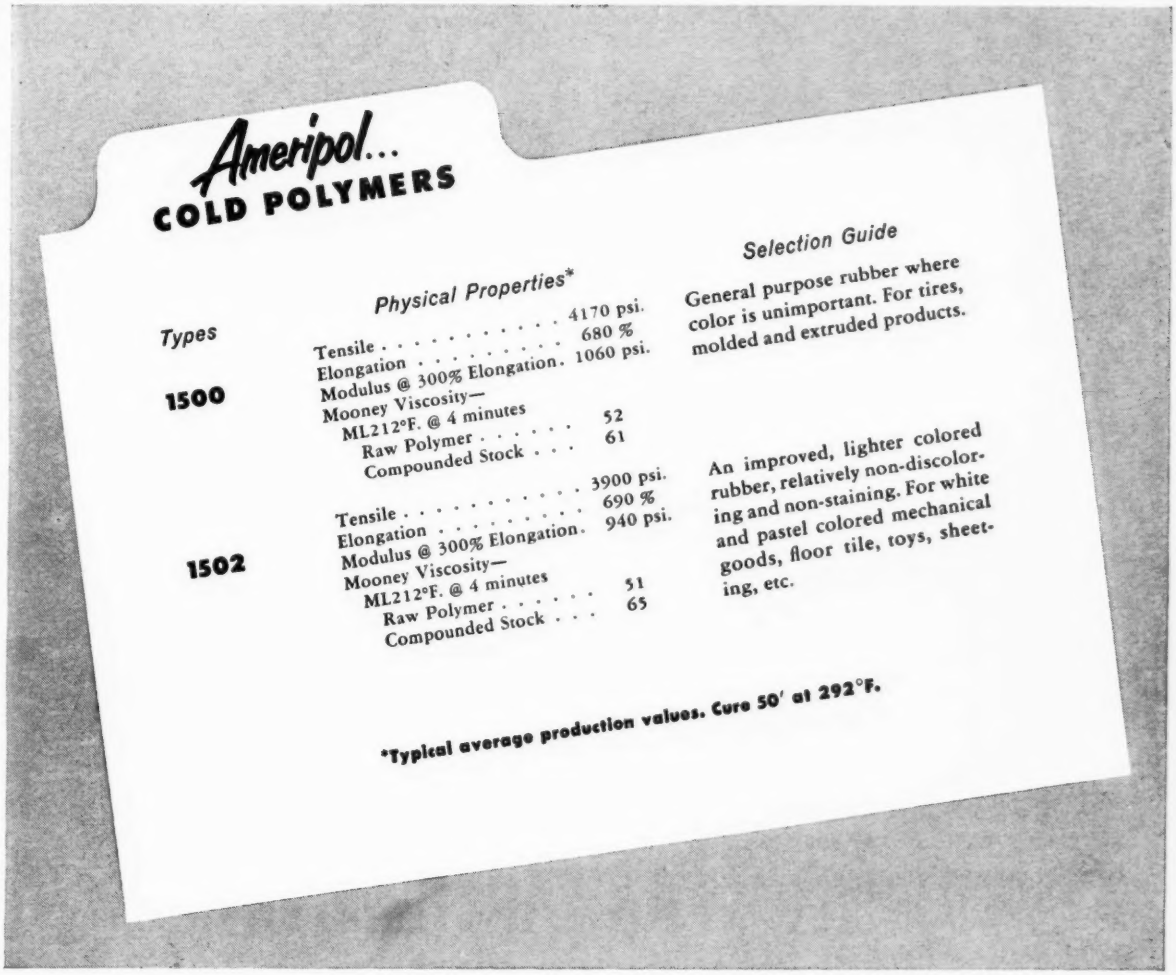
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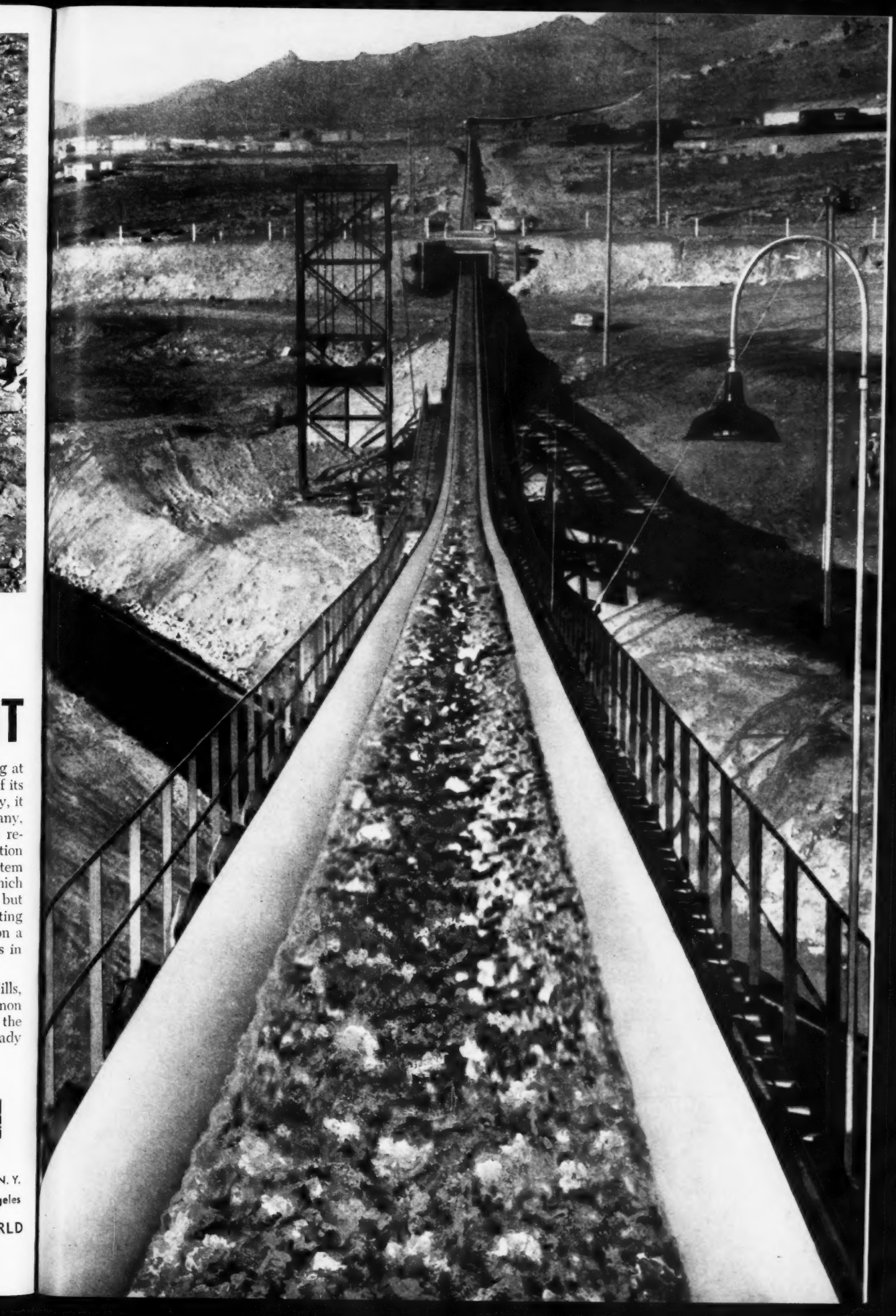

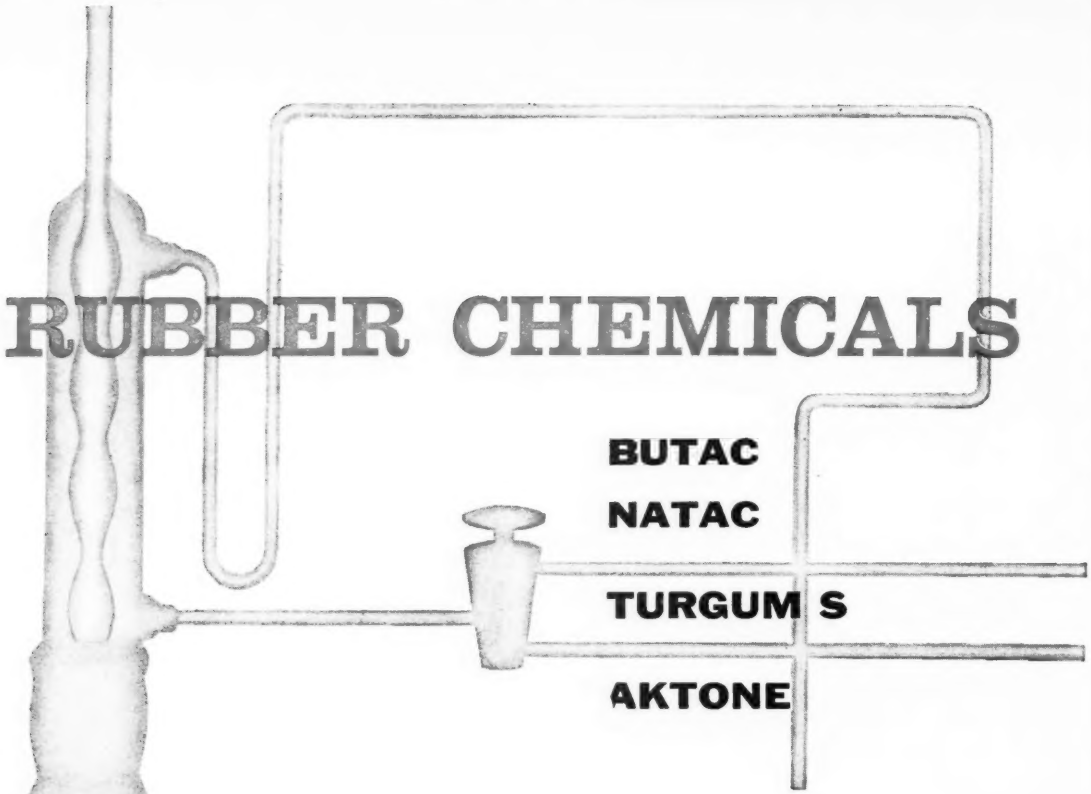

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RUBBER WORLD

EDITORIAL

JULY, 1957

"Rubber" and "Plastic" Need To Be Redefined

"RUBBER," the term coined by the English natural philosopher, Joseph Priestly, in 1770, as "a substance excellently adapted to the purpose of wiping from paper the marks of a black lead pencil," which is now applied to literally hundreds of materials of natural and synthetic origin, has never been precisely and scientifically defined. *Recent events indicate the need of such a definition is becoming increasingly urgent.*

As long as natural rubber was practically the only basic raw material used by the industry, the problem of what one meant by "rubber" was not of major concern. Since World War II, however, a legion of new synthetic rubbers and plastics has been developed and used, and more are on the way. In many cases the technical people involved in the development and use of these new materials differ in their opinions as to whether some of them should be classed as rubbers or plastics. In addition, difficulties have arisen because of the necessity of defining a given material as a rubber or a plastic because of legal or contractural obligations.

The rapid increase in the use of both soft and hard cellular products made from these new high molecular weight polymers has probably done more than anything else to focus attention on the need of better descriptions for rubbers and plastics, as such. As long as the cellular rubber products were mostly chemically blown sponge or latex foam, the problem again did not cause too much concern. The advent of vinyl, styrene, and urethane foams, however, introduced new complications since these materials could be made to have properties that could be considered as rubber-like or plastic.

The American Society for Testing Materials, which has a considerable interest in defining materials used by industry, is trying to work out some kind of agreement on definitions for rubbers and plastics for these newer materials, between its Committee D-20 on Plastics and its Committee D-11 on Rubber, with special reference to cellular products. The Plastics Committee has decided to limit its activities to rigid vinyl and urethane foams at the present time, but is giving consideration to the need of a separate committee to work only on cellular products of all types, as a possible solution to the problem.

The recently published "Glossary of Terms Relating to Rubber and Rubber-Like Materials," of Committee D-11 defines rubber, in part as: "An elastomer that can be or already is vulcanized." An elastomer, in turn, is defined as: "A substance that can be stretched at room temperature to at least twice its original length and, after having been stretched and the stress removed, returns with force to approximately its original length in a short time."

Committee D-20 has defined a plastic as: "A material that contains as an essential ingredient an organic substance of large molecular weight, is solid in its finished state, and, at some stage in its manufacture or in its processing, can be shaped by flow."

It is apparent that there is room for improvement in all of these definitions, and scientists and technologists in both industries are urged to contribute their thoughts in this connection to ASTM or this publication.

R. G. Seaman

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A Versatile New Family of Elastomers—I[1]

By G. E. MEYER, W. E. GIBBS, F. J. NAPLES, R. M. PIERSON, W. M. SALTMAN, R. W. SCHROCK, L. B. TEWKSBURY, G. S. TRICK

Goodyear Tire & Rubber Co., Akron, O.

A versatile new family of elastomers has been prepared by free radical addition of aliphatic mercaptans to the double bonds of diene polymers. High saturation levels were readily achieved without degradation of the basic polymer chain. The technology is similar to ordinary emulsion polymerization.

By varying the nature of the base polymer, the mercaptan used, and the extent of saturation, a wide range of compositions and of physical properties was attained in the adducts. In general, resistance to aging, ozone attack, heat, solvent swelling, to permeation by gases, and to gamma radiation increased with increasing saturation.

Adducts with saturation levels up to about 85% could be cured by the same procedures used for the base polymers. Higher saturation levels required activated or "butyl rubber type" curing systems.

RESEARCH and commercial developments in the field of reaction products of diene rubbers and simple non-polymerizable chemical compounds have been on the wane since World War II, probably owing more than any other cause to the fact that properties formerly sought in rubber derivatives can be more easily and cheaply attained in the ever-increasing family of olefin polymers. So far as is known, no truly *elastomeric* rubber derivatives have ever been commercialized, probably because of the comparative unavailability of coreactants which would lead to rubbery rather than resinous products.

The present paper deals with a versatile family of specialty rubbers derived from the reaction of the double bonds of conventionally prepared diene rubbers with low molecular weight alkyl mercaptans. The reaction is usually carried out in latex form, and the general technology and equipment used in making styrene-butadiene rubber (SBR) and like polymers lend themselves well to the preparation of the "adduct" derivatives.

At high extents of saturation, the products become very interesting from a commercial standpoint. Attainment of good aging, heat resistance, balance between low-temperature properties and solvent resistance, low gas permeability, or ozone resistance, in one or another of the derivatives makes them excellent candidates as competitors for the various specialty rubbers now available. The evaluations and comparisons with other polymers described herein were designed primarily to reflect the performance of the basic polymers themselves and, hence, have been run mostly in gum stocks or in standard loaded recipes. Except for some test data on a few typical end-use stocks described at the end of the paper, no efforts are reported here on attempts to attain maximum performance under extreme conditions, of the type of interest for military applications.

Prior work in the field of mercaptan-diene rubber adducts—that is, where simple alkyl mercaptans lacking any polar groups were involved—was centered largely in the early years of the 12-year long United States Government-sponsored synthetic rubber program. Interest in the reaction appears to have been confined largely to its value in shedding light on the mechanism of free radical polymerization and on the structure of the polymer (relative proportion of external to internal double bonds, etc.).

The most significant work is that of Marvel, Snyder, and coworkers at the University of Illinois (1-4),[2] Kolthoff and coworkers at the University of Minnesota

[1] Based on a paper presented before the Joint Wright Air Development Center-University of Dayton Conference, Dayton, O., Mar. 27-28, 1957, by Dr. Meyer. This same paper was presented before the International Synthetic Rubber Symposium, London, England, Mar. 26-28, 1957, organized by the *Rubber and Plastics Age*, London. Simultaneous publication in RUBBER WORLD and *Rubber and Plastics Age* has been arranged for in view of the above facts.

[2] Numbers in parentheses refer to Bibliography items at end of this installment.

(5-8), and the Standard Oil Development group under Swaney (9-14). Except for routine examination of stress-strain, rebound, and flex properties, of a few 5-15% saturated adducts by the latter workers (9, 14), little or no interest appears to have been shown in the intrinsic properties of the reacted rubbers themselves. Pertinent patents in the field appear to be those of Swaney and Banes (14), Swaney and Serniuk (15), Fryling (16), and Pritchard (17), where interest appears to have been directed to use of the adducts as lube oil additives or as rubber plasticizers.

There has also been some reported interest in the mercaptan-olefin double-bond addition reaction to confer specific polar groups using thioglycollic acid and like compounds (18-22). The use of dimercaptans (23) and dithiol acids (24) for use as cross-linking agents for rubber has also received some attention.

Preparation of Adduct Polymers

The basic reaction for the preparation of diene rubber-alkyl mercaptan polymers is given below:

This is a highly simplified representation of a quite complex set of chain reactions involving several types of double bonds. Generally, the reaction is carried out in latex form: the appropriate stripped latex is charged to an evacuated autoclave along with the desired mercaptan (somewhat in excess of the amount needed to reach the desired saturation) and a free radical initiator, such as bis-azo-isobutyronitrile, (AIBN).

The reaction can be conveniently carried out at any of a variety of temperatures—usually in the range of 30 to 60° C., depending on the type of initiator and mercaptan used. The reacted latex is degassed, stripped, antioxidant added, coagulated, washed, dewatered, and dried in essentially the same manner as used for processing SBR.

Except for a few reactions carried out in solution, all of the polymers referred to herein were prepared by this general technique. Inasmuch as the present paper is concerned primarily with the properties and the structure of the polymers themselves, further details relating to preparation are omitted.

Terminology

The term "% saturation" is used throughout to denote the extent to which the *original* double bonds in the base polymer are presumed to be saturated with mercaptan, based on one or more analytical methods for measuring the amount of mercaptan added. Thus, a "50% saturated adduct of methyl mercaptan and polybutadiene" would imply that 0.50 x 48 = 24 parts by weight of mercaptan had combined with 54 parts by weight of polymer to yield 78 parts of product. The adduct would then appear to have only 0.5 x 54/78 x 100 = 34.6% of the saturation value of the starting material, on a weight basis. The latter notation is not employed in this paper, since its use makes it too difficult to compute the amount of mercaptan added or the fraction of double bonds reacted.

Experimental Methods and Materials

Methods

MEASURMENT OF EXTENT OF SATURATION. Three methods were used for quantitative work: solids increase of the latex, refractive index increase of isolated and dried polymer, and sulfur content as determined by the Parr bomb method. Agreement was excellent when corrections were made for non-polymer constituents (soap, etc.) that were present when solids measurements were made, but which were removed by purification for determinations of either sulfur content or refractive index. Virtually all the data on % saturation cited in this paper are based on Parr bomb determinations, except where otherwise shown.

A formula for converting sulfur content to % saturation is:

$$\% \text{ saturation} = \frac{100 \times \frac{S}{32.07} \times M_S}{B\left(100 - \frac{S}{32.07}\right)M_{RSH}}$$

for polybutadiene and methyl mercaptan:

$$\% \text{ saturation} = \frac{168.66\,S}{(100 - 1.50S)}$$

where:

S = % sulfur
M_S = molecular weight of polymer segmer
B = weight fraction diene segmer in polymer
M_{RSH} = molecular weight of mercaptan added

The question of whether a 1:1 correspondence between sulfur atoms and double bonds reacted can be assumed throughout the saturation range is discussed briefly elsewhere in the paper.

GENERAL PHYSICAL PROPERTIES. Stress-strain, Goodyear rebound, permanent set, abrasion, hardness, and the like were all run by standard rubber testing methods. Dynamic data were measured in the forced vibrator type of equipment described by Gehman and coworkers (25).

OXYGEN ABSORPTION MEASUREMENTS. The apparatus of J. O. Cole, of this laboratory, for measuring the rate of oxygen absorption differs in some minor respects from that described by Shelton and Winn (26). The capillary inlet for oxygen is attached to the bottom of the absorption tube, while the top of the tube is closed with a solid stopper. The tubes are heated in a thermostatted aluminum block. A manometer attached to each tube-buret system permits the reading of the volume at any predetermined pressure, (740 millimeters in our apparatus). The volume of the system at zero reading of the buret is about 220 milliliters.

In the runs for which absorption by unprotected rubber is reported in this paper all samples were pressed on to aluminum screening, which had been washed in benzene. The thickness of the sample was 0.028-

The Authors

Glen E. Meyer

Glen E. Meyer and Robert M. Pierson, two of the senior authors of this paper, were responsible for its presentation before the International Synthetic Rubber Symposium in London, England, March 26-28, in one case, and before the Joint Wright Air Development Center-University of Dayton Conference on Elastomers of Air Weapons, Dayton, O., May 27-28, in the other.

Glen E. Meyer, head, reactive diene rubber section, research division, Goodyear Tire & Rubber Co. received his B.S. degree from Albany College in 1935, and his Ph.D. in physical chemistry from Johns Hopkins University in 1939.

Dr. Meyer did post-doctorate research at Johns Hopkins University in 1939 and 1940 and was also with the U. S. Army Chemical Warfare Service in 1940. He was with the Plantations Division, U. S. Rubber Co., in Sumatra in 1941, and the Naugatuck Chemical Division of the same company, 1942-1945; then he returned to the Plantations Division in Malaya (1946-1949). From 1950-1952 he did technical sales service for Latex and Rubber, Inc. He joined Goodyear in 1953 and was assigned his present post in 1956.

He is a member of the American Chemical Society and its Division of Rubber Chemistry.

Robert M. Pierson

Robert M. Pierson, manager, synthetic rubber research, received his Bachelor of Science degree in chemical engineering from Princeton University in 1940.

Mr. Pierson was with Kimberly-Clark Corp. in 1940 and 1941. He has been with Goodyear since 1941. He was head of the reactive diene rubber section from 1952 to 1956 and became manager of synthetic rubber research in 1956.

Mr. Pierson, furthermore, is also a member of the American Chemical Society.

to 0.030-inch, or well under the thickness above which Shelton has determined that diffusion, as well as chemical reaction, begins to affect the rate of absorption. In runs in which the protective effect of antioxidants on adduct rubber was compared, the rubber sample was plated out on benzene-washed aluminum foil by evaporation of a benzene solution in an aluminum tray.

CURE RATE STUDIES. A masterbatch of all the curing ingredients was mixed with samples of a series of adducts covering the range of saturation from 0 to 95%. The recipe contained 100 parts elastomer, 5.0 parts ZnO, 1.0 part stearic acid, 1.25 parts mercaptobenzothiazole disulfide, 0.25-part diphenylguanidine, 0.25-part tetramethyl thiuram disulfide, and 1.25 parts sulfur. Samples were cured for various periods of time at 300° F., and swelling volumes in benzene (as further described below) were determined to measure the extent of the cures.

DETERMINATION OF SOLUBILITY PARAMETER, μ. Osmotic pressure measurements of benzene solutions of adducts of methyl mercaptan and polybutadiene were made at 25° C. in Sands-Johnson type of osmometers. These data were used for calculating μ for benzene (27).

SWELLING VOLUME MEASUREMENTS FOR DETERMINING CROSS-LINK DENSITY. Measurements for either quantitative or semi-quantitative determinations of M_c, the molecular weight between cross-links, were carried out by soaking 0.1- to 0.5-gram portions of thin films in the appropriate solvent (usually benzene or p-xylene) for at least 40 hours, weighing the blotted film (enclosed in a vial), drying, and reweighing. Swelling data are reported on a volume/volume basis.

SOLVENT SWELLING IN FUELS AND LUBRICANTS. These evaluations were run by the procedure described in ASTM D 471-55T.[3] The elastomers were cured in standard curing recipes.

LOW-TEMPERATURE STIFFENING PROPERTIES. The torsional stiffness of elastomers at low temperatures (both gum stocks and loaded stocks) was measured by the method described by Gehman *et al.* (28).

HEAT AGING TESTS: Mechanical convection air ovens with temperature control of ±10° F. were used for this work.

Uncured samples were hot pressed (275-300° F.) into sheet form (approximately 0.04-inch thick) which were free of bubbles and appeared uniform throughout. Groups of these sheets were placed separately on

[3] American Society for Testing Materials 1916 Race St., Philadelphia, Pa.

watch glasses for exposure in the oven, and samples were withdrawn for examination at desired intervals. Standard tensile sheets of cured elastomers were cut into strips and hung separately in the oven for the desired periods.

OZONE RESISTANCE MEASUREMENTS. A Mast[4] ozone unit was used in which samples under both static and dynamic conditions may be exposed simultaneously. The static samples were clamped at 20% elongation, and the dynamic samples were flexed from 0 to 28% elongation at one cycle per second. In each case the samples were one- by six- inch strips cut from standard tensile sheets. The samples were inspected for degradation after 50 hours' exposure to ozone at 50 ±5 pphm. at 100° F. and at various periods thereafter as indicated in the table.

PERMEABILITY TO GASES: The hydrogen permeability determinations were made with a Cambridge fabric permeameter as described in ASTM D 815-47.[3]

Air permeability was measured on films 0.030-inch thick and 10 inches in diameter. The film was supported on the low-pressure side by pumice stone, and the amount of air going through the film under a differential pressure of 38 psi. was measured volumetrically.

GAMMA RADIATION EXPOSURES. Portions of the raw elastomers, containing no added ingredients, were pressed into small tensile sheets (one- by two- by 0.04-inch), wrapped separately in aluminum foil, and exposed to gamma radiation from a 2,000 Curie Cobalt 60 source at room temperature. This method is similar to that described by the Goodrich group (29). Swelling volume tests in benzene were used as an indication of the extent of cure.

For irradiation of loaded stocks which had been cured by conventional means, for the purpose of evaluating their resistance to degradation, a method similar to that described above was used for exposing cured samples to irradiation. Tensile and elongation characteristics were determined on portions of the samples before and after various periods of exposure.

COMPATIBILITY WITH OTHER ELASTOMERS: The method adopted was essentially that first proposed by A. Dobry (30). Briefly this consists of determining the concentration below which a solution of a pair of polymers (each at the same concentration) in a common good solvent exists as a single phase, and above which a separation into two phases occurs.

The viscosity of solutions of the soluble adducts were such that concentrations above 7% by weight could not be conveniently handled; therefore, this was the maximum concentration examined. Mill breakdown was required only in the case of natural rubber to obtain samples soluble in toluene for this work.

Equal weights of 7% solutions of the elastomers were thoroughly mixed in closed glass vials. If the formation of separate layers occurred within 24 hours, incompatibility at this level was indicated. Known proportions of toluene were added stepwise until a concentration was reached where the mixture remained as a single phase, which value was taken as a semi-quantitative measure of the compatibility. The lower the value, the less compatible are the elastomers with each other.

[4] Mast Development Co., Davenport, Iowa.

Materials

BASE POLYMERS USED FOR ADDITION REACTION. All of the base polymers used in this work were prepared in the standard "mutual" recipe of the former Office of Synthetic Rubber, Federal Facilities Corp., Washington, D. C., and polymerized at 50° C.: 100 parts of monomers; 180 parts water; 5.0 parts ORR soap flakes; 0.3-part $K_2S_2O_8$. Either no shortstop or a very small amount—e.g., 0.025- to 0.05-part of sodium dimethyl dithiocarbamate—was added, and the latices were thoroughly stripped prior to use as a base material for addition of mercaptan. Where two monomers were used, the ratio shown is that in the charge.

MERCAPTANS. Methyl mercaptan was used as received from the Industrial Division of Pennsalt Chemicals Corp. Specifications are: purity, 99% min.; distillation range, 4.5 to 7.5° C.; H_2S, 0.2% max.; methanol, 0.1% max.; cloud point, —30° F. max.; color, water white. Rate comparisons made on a specially fractionated sample of this material showed no differences.

TABLE 1. PHYSICAL PROPERTIES OF ADDUCT ELASTOMER GUM STOCKS AT ROOM TEMPERATURE

		MeSH-BR				
Elastomer	SBR 1000*	MeSH-BR	Oil MB†	MeSH-BR	MeSH-BR	EtSH-BR
% Sat. by RSH	0	46	46	75	90	70
300% Mod.	—	250	225	136	110	140
Tensile, psi.	210	340	250	470	590	260
Elongation, %	325	415	335	620	765	490
Vibrotester Dynamic mod., kg/cm²	39.2	37.4	19.7	31.3	31.3	24.2
Resilience —%	35.0	48.8	48.9	28.4	16.6	35.3

* Plioflex, Goodyear SBR.
† Masterbatch with 37.5 parts Shell Chemical Co. SPX-97 extender oil.

Likewise, a sample from Pan American Corp. gave similar results. Other mercaptans were used as received from the supplier: ethyl (Pennsalt, 99% min.); n-propyl (Pennsalt, 95% min.); isopropyl (Pennsalt, 95% min.); n-butyl (Pennsalt, 95% min.); n-amyl (Pennsalt, 95% min); n-octyl (Hooker Electrochemical Co., ca. 95%); n-dodecyl, DDM, was regular synthetic rubber grade, not distilled, 14.0% min. mercaptan sulfur content.

Compositions Studied

All three of the major compositional parameters were studied in relation to properties to at least some degree: (1) type of base polymer; (2) extent of saturation of the double bonds; (3) chain length and nature of mercaptan used for saturation.

With respect to the nature of the base polymer,

TABLE 2. PHYSICAL PROPERTIES OF ADDUCT ELASTOMERS. BLACK REINFORCED STOCKS AT ROOM TEMPERATURE

Elastometer	SBR 1000*	Polybutadiene (BR)†	MeSH-BR	MeSH-BR	MeSH-BR
% Sat. by RSH	0	0	60	80	90
300% Mod.	1270	1500	1670	1925	1200
Tensile, psi.	2750	1750	2800	2750	2650
Elongation, %	530	330	480	430	630
Rebound—Goodyear	56.5	60	40.3	44.1	43.0
Ring abrasion, cc. loss	3.6	2.6	2.8	3.4	5.8
Shore A hardness	57	63	66	66	64
Permanent set, %	3.3	4.0	1.1	1.4	3.5
SBR tear, cold	260	—	75	133	271
Hot	120	—	20	41	215.s

* Plioflex, Goodyear SBR.
† Base polymer for adducts.

most of the effort has been directed to polymers and copolymers of emulsion polymerized butadiene (BR); polymers of isoprene—both natural (NR) and synthetic (IR)—have also been used, as well as polychloroprene (CR). Because performance in aging, solvent resistance, etc. improves as the extent of saturation increases, adducts of polymers whose double bonds have been at least 50% saturated—and usually 70% or more saturated—have commanded the most attention. In a like vein, research effort on the different alkyl mercaptans was somewhat in proportion to the attractiveness of their present or potential price structure; the low molecular weight mercaptans, especially methyl, merited the greatest attention in this respect.

Rather than report the performance data in terms of each compositional variable separately, it was deemed simpler to discuss the various properties separately, with observations on how composition affects each. This is done in the following section.

Performance—Physical Properties

General Physical Properties

The technology of using adduct elastomers—processing, compounding techniques, curing recipes, fabricating methods—follows very closely the methods conventionally used for the standard diene rubbers. Handling properties appear to be indistinguishable from those of hot SBR; if anything, there appears to be a tendency for "smoother" extrusion, mill banding, etc. As further noted later in this section, cure recipes require little or no adjustment except for highly saturated adducts.

Some typical gum stock stress-strain and dynamic data for mercaptan adducts of polybutadiene are compared with those of hot SBR and polybutadiene in Table 1. More complete physical data on tread-type stocks are given in Table 2. Except for a somewhat lower rebound, adduct elastomers appear to be quite similar to SBR in most of the usual physical properties. The features which distinguish them for special applications are discussed in later sections.

The ease of curing methyl mercaptan adducts of BR of increasing degrees of saturation in conventional gum stock recipes appears to be only slightly affected until a saturation level of approximately 85% is reached. The swelling volume measurements listed in Table 3 indicate that elastomers of this series in the range of 50 to 80% saturated are somewhat more readily cured than the base polybutadiene and much more easily cured than the adducts at the highest saturation levels.

TABLE 3. THE EFFECT OF SATURATION LEVEL ON RATE OF CURE OF CH_3SH-BR ADDUCTS—GUM STOCKS

Saturation %	Swelling Volume in Benzene Minutes Cured at 300° F. 20	40	60
0	5.4	5.6	5.3
34	6.2	6.3	5.7
47	5.5	5.3	5.2
67	5.1	4.8	4.4
76	5.4	5.1	5.2
86	5.3	5.1	5.6
93	6.1	5.9	5.6
97	24.	15.	12.

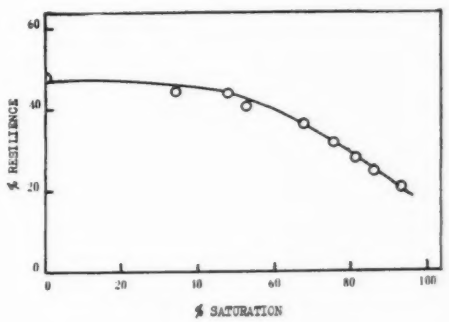

Fig. 1. Effect of saturation level on resilience of BR-CH_3SH elastomers

In order to translate the swelling volume values directly into states of cure the solubility parameter, μ, for the elastomer at each saturation level would have to be known. Experience with these elastomers has shown that swelling volumes above 6 or 7 indicate relatively low states of cure. The 97% saturated adduct at a swelling volume of 12 (60-minute cure) is still very lightly cured.

In other cure rate studies (not shown) the very highly saturated adducts have been cured satisfactorily in activated or "butyl rubber" type of curing systems.

As mentioned above, the rebound (or resilience) of adduct elastomer is a function of the saturation level. Vibrotester resilience values for gum stocks of methyl mercaptan adducts of BR, confirming the rather unpromising resilience properties, are plotted against saturation levels in Figure 1.

The dynamic modulus of an adduct elastomer is markedly influenced by the molecular weight of the

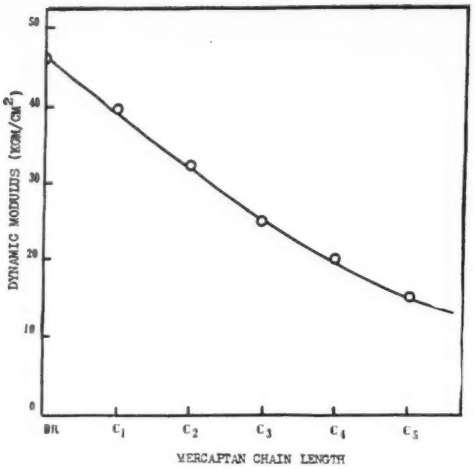

Fig. 2. Effect of mercaptan chain length on dynamic modulus of BR adducts

mercaptan used in its preparation. Increasing the molecular weight of the added mercaptan—at least up to C_5—decreases the Vibrotester dynamic modulus, in common with effects observed in lengthening the chain of substituent groups attached to other elastomeric polymers.

Over quite a wide range of saturation levels (ca. 40 to 75%) the dynamic moduli of the cured gum stocks are nearly constant for each mercaptan. These values have been plotted against mercaptan chain length, in Figure 2, up to amyl mercaptan.

The dynamic modulus of the methyl derivatives (ca. 40-45 kg/cm²) falls in about the same range as SBR; the propyl derivatives give moduli in the natural rubber range (ca. 25 kg/cm²).

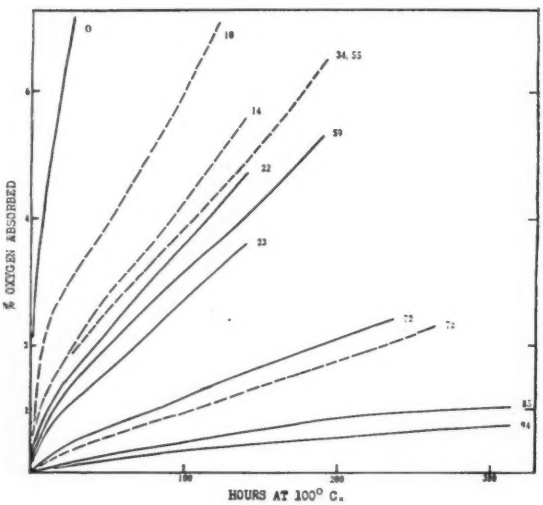

Fig. 3. Rate of oxygen absorption by BR-CH_2SH elastomers having various levels of saturation. Numbers opposite curves give % saturation. 0 is unreacted BR

Basic Age Resistance and Mechanism of Air Aging

In order to obtain quantitative data on the relative susceptibility to oxidation of adducts of different degrees of saturation, and on attendant effects of oxidation, (such as auto-inhibition and production of sulfoxide or other chemical groups), it was decided to adopt volumetric oxygen absorption rate studies using the apparatus of J. O. Cole. The latter is similar to that described by Shelton and Winn (26), except that manometers are used to take readings of constant pressure. Chemical and spectrochemical analysis were used to supplement the oxygen absorption.

The absorption apparatus is described in the experimental section. Oxygen uptake was measured on both purified unprotected, uncured adduct and on uncured adducts stabilized with antioxidants. While of

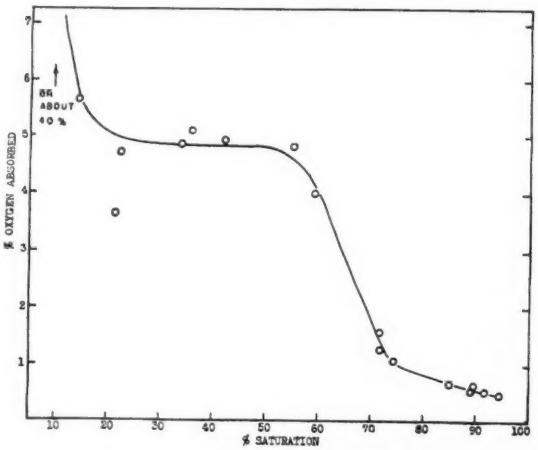

Fig. 4. Oxygen absorbed after 140 hours vs. % saturation of BR-CH_2SH elastomers

little practical use in themselves, the measurements on the purified polymers were of considerable value in rating the basic age resistance of the polymers *per se*.

Observations as to the chemical effects of air aging are discussed in later portions of this section.

Oxygen Absorption Measurement On Methyl Mercaptan Adducts of Varying Saturation. Absorption rate curves (at 100° C.) of two series of well-purified methyl mercaptan-polybutadiene adducts covering a range of saturations are reproduced in Figure 3. The range extends from BR itself to adducts over 90% saturated. On the graph the numbers indicate the % saturation.

The rate curves show that BR takes up 7% within a day; whereas methyl mercaptan-polybutadiene adducts absorb oxygen at dramatically lower rates; the rate is inversely dependent on the extent of saturation.

At the highest saturations the rate approaches that of BR protected with an efficient antioxidant, phenyl-beta-naphthylamine (PBNA). Close inspection of the family of rate curves reveals that, after the initial decrease of rate with increase in saturation, there is a clustering of curves for adducts in the 20 to 60%

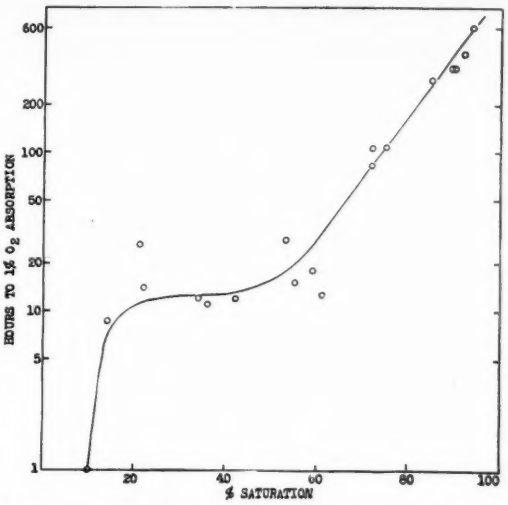

Fig. 5. Hours to 1% oxygen absorpton related to % saturation of BR-CH_2 SH elastomers

saturation range, then a group of curves around 70% saturation, and finally a clustering of most horizontal curves for the 85 to 94% saturated adducts.

This relation between % saturation of the adduct and the rate of its absorption is more readily seen in Figure 4, where the % oxygen absorbed after 140 hours is plotted against the % saturation for the same group of adducts. Here, points for samples having saturations between about 20 and 60% form a region wherein absorption is roughly independent of % saturation; it amounts to about 5%. After 60% saturation, the curve shows a sharp drop to 1% for the 70% adducts, then falls slowly to about 0.5% for the highest saturated adduct tested.

A different treatment of the same data is shown in Figure 5, wherein the hours to 1% absorption (log function) are plotted against % saturation. Again, a rather wide scatter persists up to 60% saturation, but a saturation-independent region appears, followed by a sharp rise in hours to the higher-saturated region. The hours estimated for the 94% saturated sample (last point) were 600. While extrapolation to 100% saturation would seemingly imply a lifetime in excess of 1,000 hours (to 1% absorption), it must be pointed out that the reliability of saturation values in the 95-100% region is open to question on two counts: (1) the 1:1 correspondence between sulfur atoms and double bond disappearance has not been conclusively shown at high saturations; (2) chemical methods (iodine number, bromine number, etc.) have yet to show that diene polymers themselves have 100% of the theoretical value of unsaturation.

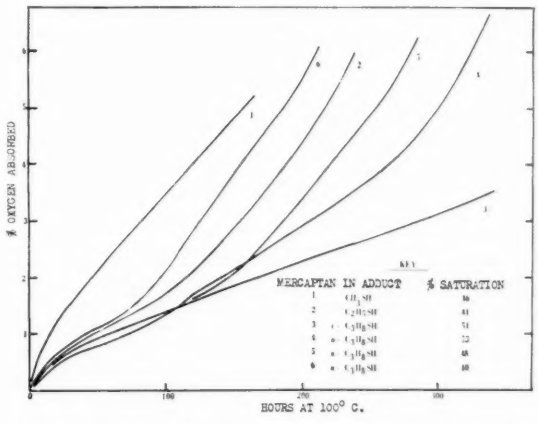

Fig. 6. Rate of oxygen absorption of methyl, ethyl, isopropyl, and n-propyl mercaptan BR elastomers

TABLE 4. COMPARISON OF ANTIOXIDANTS IN ADDUCT ELASTOMERS BY OXYGEN ABSORPTION AT 110° C.

Elastomers	Antioxidant Pts. per 100	% Oxygen Absorbed after 100 Hrs.	200 Hrs.	400 Hrs.	570 Hrs.
SBR 1500	1.25 PPDA*	1.30	2.0 (est'd)	discontinued	
Neoprene GN	(as received)	3.80	discontinued	—	
Hycar PA	(as received)	1.85	2.33	discontinued	
Hypalon	(as received)	0	0.37	1.55	2.72
92% Adduct	none	1.86	2.14	discontinued	
92% Adduct	1.25 W-S†	0.62	0.95	1.30	1.62
92% Adduct	1.25 AP‡	0.55	0.80	0.80	1.00
92% Adduct	1.25 A.O. 2246§	0.62	0.95	1.10	1.21
92% Adduct	1.25 PBNA**	0.75	0.80	1.15	2.28
92% Adduct	1.25 PPDA*	—	0.60	1.25	3.34
92% Adduct	1.25 NDPA††	0.65	0.80	1.05	1.86
92% Adduct	1.25 ADPA‡‡	0.70	0.70	0.95	2.30
92% Adduct	1.25 DHQ§§	0.88	1.05	1.75	3.90
92% Adduct	1.25 DTBH¶	1.15	1.50	3.00	discontinued

* A para-phenylenediamine derivative.
† Wing-Stay S.
‡ An alkylated phenol.
§ Bis(2-hydroxy-3-*t*-butyl-5-methylphenylmethane).
** Phenyl-beta-naphthylamine.
†† A nonylated diphenylamine.
‡‡ An acetone-diphenylamine reaction product.
§§ A dihydroquinoline derivative.
¶ Di-*t*-butylhydroquinone.

OXYGEN ABSORPTION BY ETHYL, ISOPROPYL AND *N*-PROPYL MERCAPTAN ADDUCTS OF BR. Figure 6 depicts the oxygen absorption rate at 100° C. of purified adducts of polybutadiene and methyl, ethyl, isopropyl and *n*-propyl mercaptans, all in the range of 30 to 50% saturation. The absorptions plotted take into account the higher molecular weight of the ethyl and propyl adducts.

It is evident from the graph that adducts of the higher molecular weight mercaptans are appreciably more resistant in the unprotected state to oxygen attack than the methyl mercaptan adduct. The isopropyl mercaptan adduct is especially resistant in comparison with the methyl, since even the 33% (Curve 4) saturated isopropyl adduct absorbs oxygen at only about half the rate of the 46% (Curve 1) saturated methyl adduct.

The cause of this difference between adducts of the different mercaptans is suggested by the infrared spectra of the various adducts. In a 50% saturated

isopropyl adduct, for example, the band for the vinylic grouping (11.0 micron band) has almost disappeared; whereas in the corresponding 50% saturated methyl adduct this band is still very prominent (and disappears only by about 70 to 75% saturation). Hence the much lower concentration of the reactive vinylic groups in the isopropyl adduct confers the greater oxygen resistance.

Considering the 140-hour absorption of the 50% saturated isopropyl adduct (1.8%) and referring to Figure 4 reveal that this isopropyl adduct is equivalent in oxygen resistance to a methyl adduct having 70% saturation. There may also be a chemical effect on the adduct of the presence of different alkyl groups attached to sulfur, but any such effect cannot be distinguished in these data alone.

COMPARISON OF ANTIOXIDANTS IN BR-METHYL MERCAPTAN ADDUCT. An unpurified and unstabilized BR-methyl mercaptan adduct having a saturation of 92% was used as a base material for comparison of the effectiveness of certain of the common types of antioxidants in retarding absorption of oxygen. A higher temperature (110° C.) was used because of the lesser reactivity of the protected polymers. There were also included in this series of tests four commercial age-resistant synthetic elastomers: Neoprene GN (CR),[5] Hycar PA[6] (polyethyl acrylate copolymer), Hypalon[5] (chlorosulfonated polyethylene), and SBR 1500 with 1.25% of p-phenylenediamine-type antioxidant.

The first three were evaluated as received—i.e., with whatever antioxidants are incorporated by the manufacturers.

The results are given in Table 4.

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(To be continued)

[5] E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.
[6] B. F. Goodwich Chemical Co., Cleveland, O.
[7] The CR Reports are available from the United States Department of Commerce, Office of Technical Services, Technical Reports Section, Washington 25, D. C., by citing the CR number and indicating it is listed in PB 118310.

Research for the Small Business

The "practical" minimum budget for a small business to have its own research is $120,000 a year, the American Institute of Management, New York, N. Y., has found in a study of American Industry. This research budget includes a research team of about five scientists and five other personnel plus an initial $50,000 for capital outlay, the AIM report says. Although research could be carried on by a single scientist, a formal department usually works out to the above minimum.

Only about 10% of the country's small manufacturers have their own research facilities; while only about 20% support real research in any way at all, the study indicates.

For those small companies, earning under $100,000 a year and having a net worth of under $1,000,000, which do not set up their own research facilities, AIM has described names and methods of operating of noted outside research foundations and laboratories where anyone can have a product tested or a problem solved. Sample problems and their cost are cited.

The six-page report is contained in the May, 1957, issue of "The Corporate Director," published by AIM for its members. According to AIM, the study was undertaken to answer many questions from members who believe that their small companies are prohibited by economic necessity from participating in the billions of dollars for research poured out annually by government and large business. Not too long ago the AIM reported that more than half of the 65 million jobs in America are in industries which owe their birth to the nation's research laboratories.

Many of the problems inherent in using outside research can be met by having some major executive of the company assigned the task of following the company's outside research and, at the same time, technical developments in the entire industry, according to "The Corporate Director." This executive can follow the technical journals relating to his industry, read government reports, attend scientific meetings, and then represent his firm at meetings with the researchers.

Urethane Elastomers[1]

By W. G. OGDEN
E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Polyurethanes are a radically new synthetic elastomer type with outstanding physical characteristics. A number of types of urethane elastomers have been introduced in the recent past.

In the field of solid urethane elastomers, a new type that can be cured with sulfur and conventional accelerators has been developed.

The new-type urethane elastomer has greatly improved processing characterstics, storage and thermal stability, and other advantages as a result of the change from the conventional diisocyanate curing systems to the sulfur and accelerator system.

SINCE the 1930's the rubber industry has witnessed the growth of no less than 19 basic synthetic elastomer types. The newest of these elastomer types, the polyurethanes, is one of several materials from the field of isocyanate chemistry.

Isocyanate chemistry is today enjoying widespread attention. Patents in this field both in the United States and abroad number in the hundreds. The number of recent articles dealing with both technical and economic aspects of this field is a further evidence of the current interest it enjoys.

We can divide the isocyanate end-product field into three major segments: foams, liquids, and solids. This paper will deal only with solid polyurethane elastomers.

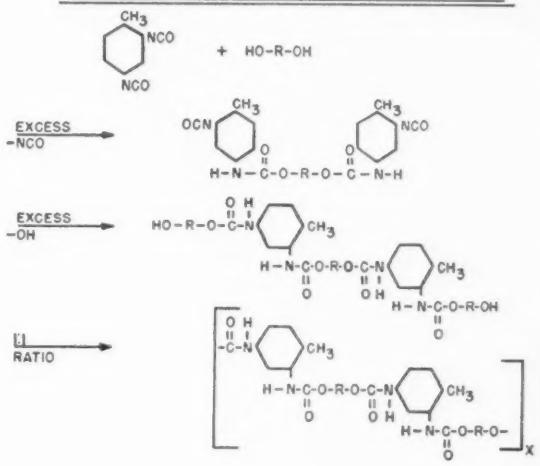
Urethane Chemistry

These polyurethane elastomers are a radical departure from the basic system common to all other types. They are condensation polymers rather than the addition types of the conventional elastomeric polymer. The chemical basis for polyurethane polymers is the reaction of diisocyanates with diols.

The reaction of a diisocyanate with a glycol is illustrated below. The diisocyanate shown here is toluene diisocyanate; the glycol is shown schematically. In practice, it is usually a hydroxyl terminated polyester or polyether of relatively high molecular weight.

The top arrow indicates what may occur when a large excess of diisocyanate is used. Although only one product is shown, the possibility exists for increasing the molecular weight to polymeric proportions by further reaction between these isocyanate groups and adjacent urethane hydrogens.

REACTION OF DIISOCYANATES WITH GLYCOLS



When the glycol is present in slight excess, as shown by the second arrow, the product is also polymeric. In this case, the molecular weight depends on the

[1]Presented before the New York Rubber Group, Mar. 22, 1957. Contribution No. 118 of the Du Pont company.

The Author

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Willard Stewart, Inc.

(Captions for facing page)

Fig. 1. Effect of temperature on Mooney viscosity of polyurethanes compared with natural rubber

Fig. 2. Mooney viscosity at 212° F. vs. rotor speed for polyurethanes and natural rubber

Fig. 3. Comparison of Mooney scorch curves for Adiprenes B and C with natural rubber

Fig. 4. Tensile strength and 300% modulus for various cures of Adiprene C in formulation containing sulfur

Fig. 5. Effect of carbon black loading on Adiprenes B and C

Fig. 6. Typical stress-strain curve for Adiprene C

Fig. 7. Tear strength at various temperatures for Adiprenes B and C and LTP SBR

Fig. 8. Comparison of oxygen bomb aging of Adiprene C, NR, and SBR

weight of the starting glycol, as well as on the temperature and time of reaction.

If a 1:1 ratio is used, the product will be theoretically a polymer of infinitely long chain. Of course, this is never achieved practically, owing to various side reactions.

It is immediately apparent that this reaction is a versatile one, for by selecting various types of diisocyanates and glycols, almost infinite combinations of polymeric materials can be produced.

A number of urethane elastomers have been introduced utilizing various combinations within the basic reactions just described. Du Pont has under development a polyurethane elastomer, Adiprene C, which is unique in that it can be cured with sulfur and conventional accelerators. This is a radical departure from the diisocyanate curing system used with Adiprene B, Du Pont's first polyurethane elastomer.

Vulcollan,[2] Chemigum SL,[3] and Estane[4] are other brands of urethane elastomers which are similar to Adiprene B in their physical properties. We are, perhaps, most familiar with the Vulcollan types of polyurethane which are processed by casting methods and other fluid techniques. The Du Pont polyurethanes are different in that they can be processed in conventional rubber processing equipment. Another distinctive characteristic of these polyurethanes is that they are reinforced by fillers.

Adiprene C can be processed and cured with little deviation from methods common to natural rubber and SBR. Greatly improved processing, storage stability, and thermal stability are results of the change from the conventional diisocyanate curing systems.

While Adiprene B can also be processed on conventional equipment, special techniques and close scheduling are necessary. These handling problems are primarily a result of the method of cross-linking which utilizes the reaction of diisocyanates with active hydrogens in the polymer chain.

Rheological Properties

Before discussing specific processing characteristics, it will be helpful to consider the basic rheological properties of these polymers.

The curves in Figure 1 were obtained by plotting Mooney viscosity[5] as a function of stock temperature. The small rotor was used, and the speed was held constant at 2 rpm. The slopes of the curve indicate that both polyurethanes are considerably more thermoplastic in the uncured state than is natural rubber. The abrupt change in slope shown for Adiprene B indicates a change in flow characteristics, at a temperature of 250° C.

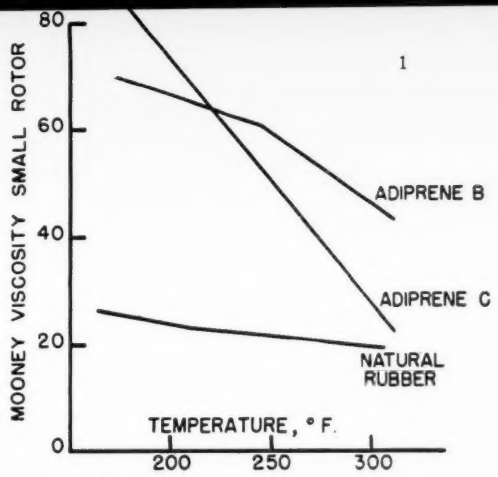
At room temperature both of the Du Pont polyurethanes exhibit high Mooney viscosity and low plasticity, as judged by the Williams test.[6] Taken alone, this condition might lead to the conclusion that they are very difficult to process. Actually, they band readily on the mill and show smoothness comparable with natural rubber. The thermoplasticity we have just observed serves to explain this behavior. High initial viscosity causes rapid heat generation during milling which in turn produces rapid softening and smoothout on the mill.

Adiprene C can be processed at temperatures as high as 350° F. without difficulty. This is 100° F. higher than Adiprene B can be processed. The temperature limitation for the latter is a result of the change in flow properties observed earlier. This change in flow properties indicated by the break in viscosity *vs.* temperature plot is observed on the mill as a rough discontinuous band.

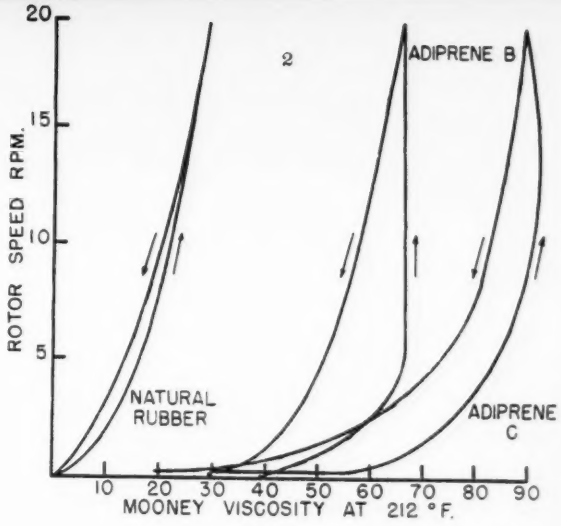
Recovery from deformation, commonly called nerve, is an important indicator for processing smoothness and dimensional stability of processed compounds. Adiprene C is comparable in nerve with natural rubber at processing temperatures even though it exhibits considerable nerve at room temperature, which point is true also for Adiprene B. The curves in Figure 2 illustrate the thixotrophic behavior of the Du Pont polyurethanes compared with natural rubber. These curves were obtained by plotting Mooney viscosity as a function of increasing rotor speeds. The method used here is that devised by Decker and Roth.[7] Viscosity curves for increasing and decreasing rotor speed are of the same general type, but the two curves are widely separated for the Adiprenes and close together for natural rubber. All three elastomers show a characteristic plastic flow curve, but the polyurethanes have a higher yield point.

This thixotrophy of the polyurethane elastomers means that flow characteristics change with rate of shear; in other words, they appear less plastic under static conditions than under dynamic conditions. Also, it will be observed that continued working reduces apparent viscosity. In the case of Adiprene C, a prebreakdown at 250° C. is recommended for large-scale

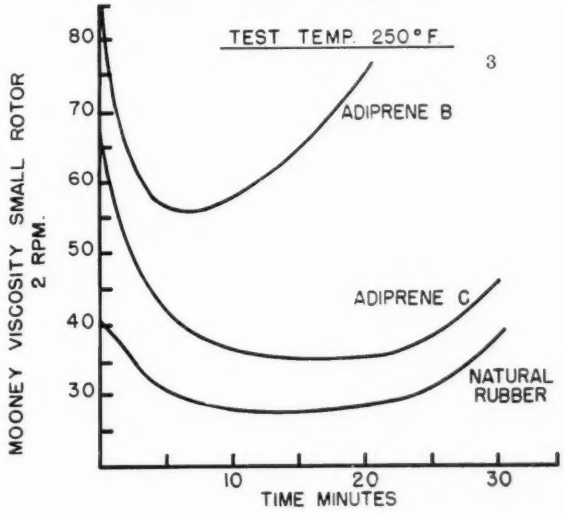
[2]Farbenfabriken Bayer, Leverkusen, Germany.
[3]Goodyear Tire & Rubber Co., Akron, O.
[4]B. F. Goodrich Co., Akron, O.
[5]ASTM D 927-55T, American Society for Testing Materials, Philadelphia, Pa.
[6]ASTM D 926-47T.
[7]RUBBER WORLD, 128, 339 (1953).


MOONEY VISCOSITY SMALL ROTOR
80
60
40
20
0
ADIPRENE B
ADIPRENE C
NATURAL RUBBER
TEMPERATURE, °F.
200
250
300

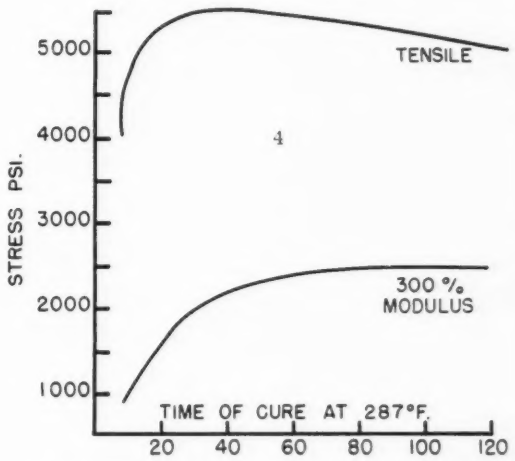
1


ROTOR SPEED RPM.
20
15
10
5
ADIPRENE B
NATURAL RUBBER
ADIPRENE C
10 20 30 40 50 60 70 80 90
MOONEY VISCOSITY AT 212 °F.

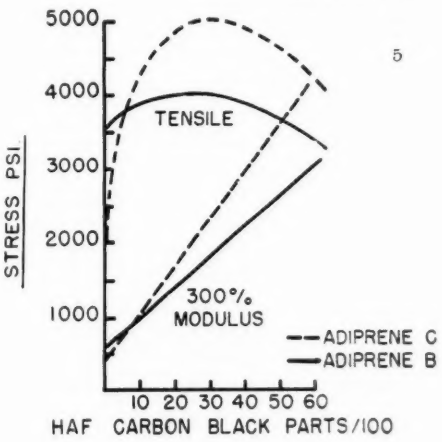
2


TEST TEMP. 250°F
MOONEY VISCOSITY SMALL ROTOR 2 RPM.
80
70
60
50
40
30
ADIPRENE B
ADIPRENE C
NATURAL RUBBER
10
20
30
TIME MINUTES

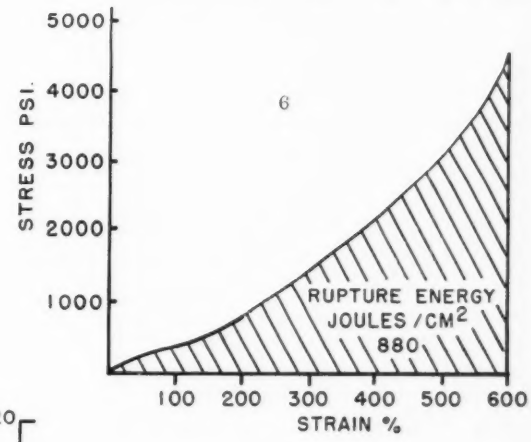
3


STRESS PSI.
5000
4000
3000
2000
1000
TENSILE
300% MODULUS
TIME OF CURE AT 287°F.
20 40 60 80 100 120

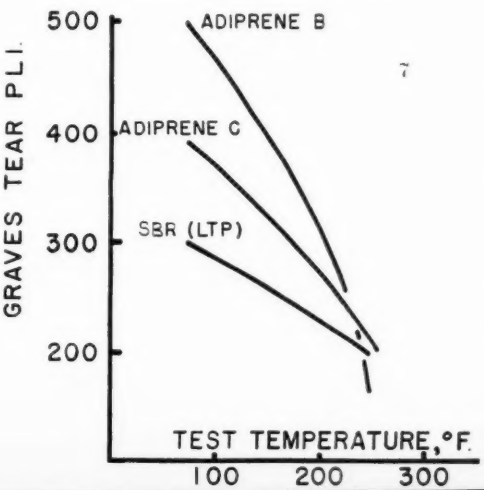
4


STRESS PSI.
5000
4000
3000
2000
1000
TENSILE
300% MODULUS
ADIPRENE C
ADIPRENE B
10 20 30 40 50 60
HAF CARBON BLACK PARTS/100

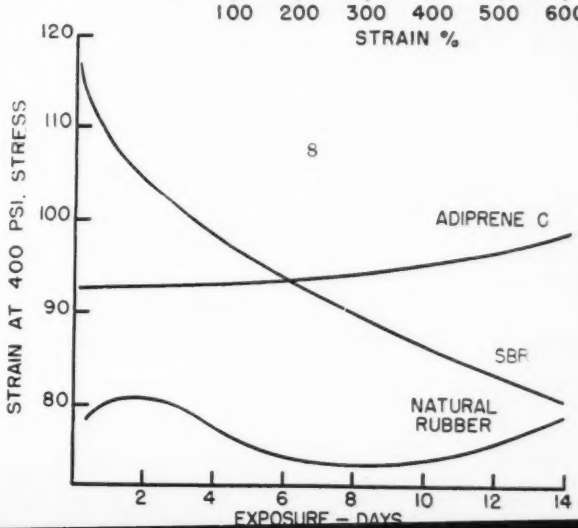
5


STRESS PSI.
5000
4000
3000
2000
1000
RUPTURE ENERGY
JOULES/CM²
880
100 200 300 400 500 600
STRAIN %

6


GRAVES TEAR PLI.
500
400
300
200
ADIPRENE B
ADIPRENE C
SBR (LTP)
TEST TEMPERATURE, °F.
100
200
300

7


STRAIN AT 400 PSI. STRESS
120
110
100
90
80
ADIPRENE C
SBR
NATURAL RUBBER
2 4 6 8 10 12 14
EXPOSURE – DAYS

8

Banbury mixing to reduce viscosity and facilitate subsequent processing.

To summarize processing behavior, Adiprene C can be processed under conditions consistent with factory requirements, as contrasted with the special techniques and close scheduling necessary with Adiprene B.

Compounding and Curing

Representative formulations for the Adiprenes are shown in Table 1. The preferred acceleration for the sulfur cure of Adiprene C is a combination of a thiazole and a thiazoline together with a special activator. This activator is a complex of zinc chloride and benzothiazyl disulfide (MBTS). You will note that the Adiprene C formulation contains no organic acid or metallic oxide. The Adiprene B formulation contains a hindered diisocyanate, Hylene[8] DMM, which provides a compromise between processing safety and adequate cure rate. Unless otherwise noted, data shown in subsequent slides were obtained for these stocks.

TABLE 1. ADIPRENE FORMULATIONS

Compound A		Compound B	
Adiprene C	100.00	Adiprene B	100
HAF carbon black	30.00	EPC carbon black	15
Cumar W 2½*	10.00	Butadiene—acrylonitrile liquid polymer	15
MBTS†	3.00	Hylene DMM**	3
MBT‡	1.00		
Activator, RCD—2098§	0.35		
Sulfur	1.50		
Cure 60′/287° F.		Cure 20′/274° F.	

* Cumarone-indene resin, Barrett Division, Allied Chemical & Dye Corp., New York, N. Y.
† Benzothiazyl disulfide, Du Pont.
‡ Mercapto benzothiazole, Du Pont.
§ Complex of zinc chloride and MBTS, Du Pont.
** Hindered diisocyanate, Du Pont.

Figure 3 is a comparison of Mooney scorch[9] curves. The sulfur cured Adiprene C stock is comparable in processing safety with a typical natural rubber tread stock. Comparison with the scorch curve for Adiprene B illustrates the improvement in processing safety obtained by the change in curing system.

Storage stability of Adiprene C stocks is excellent. Tread stocks have been cured six weeks after milling, with no change from original cured properties. Storage stability of Adiprene B stocks as well as processing safety is sensitive to moisture, owing to the reactivity of diisocyanates with water.

Cure curves for Adiprene C are shown in Figure 4. Tensile strength is developed rapidly at 287° F. Modulus reaches a maximum in 60 minutes at 287° F. and maintains this plateau through the 120-minute cure.

The data in Table 2 show the effect of curing temperature on Adiprene C. Approximately equivalent cures are shown for three curing temperatures. There is a general decrease in both modulus and tensile with increasing temperature of cure. The dropoff is not great, however; and short, high-temperature cures are feasible.

TABLE 2. ADIPRENE C—EFFECT OF CURING TEMPERATURE

Cure	300% Modulus, Psi.	Tensile, Psi.	Elongation, %
45′/280° F.	1850	4750	580
22½′/300° F.	1800	4875	620
11′/320° F.	1350	4550	680
60′/280° F.	2000	4875	550
30′/300° F.	1850	4475	590
15′/320° F.	1600	4550	620
90′/280° F.	2075	4400	510
45′/300° F.	1775	4550	590
22½′/320° F.	1600	4000	590

Adiprene C can be cured with peroxides. One advantage of peroxide cures is improved compression set at elevated temperatures, as shown in Table 3. The peroxide used here is Hercules Powder Co.'s Di-Cup 40 C, which is 40% active dicumyl peroxide.

TABLE 3. ADIPRENE C—COMPARISON OF SULFUR AND PEROXIDE CURES

	A	B
Adiprene C	100	100
EPC carbon black	30	30
MBTS	3	
MBT	1	
Activator, RCD—2098	0.35	
Sulfur	1.5	
DI Cup 40 C*		2.5
Cure 60′/307° F.		
300% Modulus, psi.	2975	2975
Tensile, psi.	5000	4975
Elongation, %	450	450
Hardness, Shore A	71	69
Compression set, ASTM D 395-55, Method B		
22 hrs/70° C.	20	18
70 hrs/100° C.	80	45

* 40% Dicumyl peroxdie, Hercules Powder Co., Wilmington, Del.

In Table 4 the effect of time and temperature on the vulcanization of Adiprene B is shown. The diisocyanate curing system is active at very low temperatures, and a fair state of cure is reached in only 20 minutes at 227° F. Modulus continues to increase with increasing temperature of cure, but maximum tensile strength is obtained with the 274° F. cure.

Adiprene C gum stocks have relatively low tensile strength, although they are considerably stronger than SBR gum stocks. Carbon black, however, has a very pronounced reinforcing effect, and a maximum tensile in excess of 5000 psi. is obtained with 25 parts/100 of

[8] Du Pont trade mark.
[9] ASTM D 1077-55T.

HAF black. In comparison, Adiprene B has a high gum tensile which is further reinforced by carbon black. Modulus shows a continued increase with increasing carbon black loading. (See Figure 5.)

TABLE 4. EFFECT OF TEMPERATURE AND TIME ON VULCANIZATION OF ADIPRENE B

Cure	300% Modulus, Psi.	Tensile, Psi.	Elongation, %
20′/227° F.	1100	3950	620
10′/274° F.	1225	4050	590
20′/274° F.	1325	4450	580
60′/274° F.	1375	4650	550
20′/307° F.	1400	3550	560

In general, trends established for various types of carbon black in SBR hold true also for Adiprene C.

Silicon dioxides and clays have shown considerable reinforcing effects in Adiprene C. These stocks, in general, require an increase in acceleration over that used for comparable black loaded stocks. Properly accelerated compounds loaded with a fine silicon dioxide have given tensiles over 4,500 psi. Tensiles of 3,000-3,500 psi. are possible with clay loaded stocks.

A number of classes of compounds are plasticizers for the Adiprenes. In general, effective plasticizers are those which are classed as polar or which are highly aromatic. These plasticizers serve to improve processability and lower the cured modulus and hardness without seriously affecting other properties. Excessive plasticizer contributes to decreased abrasion resistance. The effect on physical properties of increasing amounts of Cumar W 2½,[10] a cumarone-indene resin, is shown in Table 5. You will note that the effect on cured hardness is less than in conventional elastomers. Considerable modulus reduction, however, is obtained without excessive loss of tensile.

TABLE 5. ADIPRENE C—EFFECT OF PLASTICIZER CONCENTRATION

Adiprene C	100		
HAF carbon black	40		
Cumar W 2½	as shown		
MBTS	3		
MBT	1		
Activator, RCD—2098	0.35		
Sulfur	1.5		
Cure 60′/287° F.			
Parts Cumar W 2½	5	15	25
300% Modulus, psi.	3300	2450	1475
Tensile, psi.	4525	4200	3850
Elongation, %	400	530	580
Hardness, Shore A	76	71	68

Physical Properties

The physical properties of these two polyurethane elastomers are quite comparable. In view of this fact, it is anticipated that Adiprene C will replace Adiprene B in most applications as a result of the processing improvements which may be obtained. Therefore Adiprene C will be used in the physical property comparisons which follow.

Vulcanizates of Adiprene C have several outstanding properties, chief among which is a higher degree of abrasion resistance than is found with other elastomers. This superior abrasion resistance has been confirmed by a considerable number of tire road tests. Outstanding abrasion resistance combined with resistance to crystallization, good heat aging, resistance to ozone, oxygen, and oil suggests wide utility for Adiprene C in the elastomer field.

A typical stress-strain curve for Adiprene C is shown in Figure 6 which indicates a combination of high load carrying capacity together with excellent extensibility for this polyurethane. These combine to give an unusually high rupture energy which undoubtedly accounts to some extent for the superior abrasion resistance of Adiprene C. The bulge in the stress-strain curve between 0 and 100% elongation is indicative of high room-temperature stiffness.

TABLE 6. DYNAMIC PROPERTIES—ADIPRENES AND SBR

	Adiprene B	Adiprene C	SBR (LTP)
Yerzley resilience* at			
25° C.	70	65	58
100° C.	78	70	70
Goodrich flexometer			
1800 cycles—3/16-inch stroke—150 psi. load—20 minute run			
ΔT° C.	50	52	92
Dynamic modulus at 25° C.			
Shear—1200 rpm.			
0.1 amplitude psi.	400	390	280

* ASTM D 945-55.

Figure 7 compares the tear resistance of the polyurethanes with that of SBR. Both polymers exhibit high initial tear which falls off more rapidly than that of SBR with increasing test temperature. The problem of hot tear is minimized in practice by the high extensibility of these stocks.

In Table 6 the dynamic properties of the polyurethanes are compared with those of "cold" SBR. Both polymers show higher resilience and lower heat build-up than the SBR control. Dynamic modulus is higher than that of most elastomers.

Stress-strain properties obtained at elevated temperatures are shown in Table 7. The behavior of Adiprene C vulcanizates at elevated temperatures is roughly comparable with SBR, although the former undergoes a greater percentage drop in tensile between room temperature and 212° F.

When these same stocks are aged for eight hours at test temperature, the picture changes somewhat, as shown in Table 8. After aging, the Adiprene C stock retains

[10] Barrett Division, Allied Chemical & Dye Corp., New York, N. Y.

TABLE 7. STRESS-STRAIN PROPERTIES AT ELEVATED TEMPERATURES—ADIPRENE C, NR, AND SBR

Test temp. °F.	77	212	250	300	350
	Unaged Stocks				
	Tensile Strength, Psi.				
Adiprene C	5275	1950	1350	850	550
Natural rubber	3700	2800	2575	2150	1275
SBR (LTP)	3375	1600	1275	1000	700
	Elongation, %				
Adiprene C	530	320	240	200	150
Natural rubber	420	520	530	540	510
SBR (LTP)	480	310	260	250	210

more strength and extensibility than the SBR stock and at 350° F. is superior to the natural rubber stock which embrittles. In straight heat aging, Adiprene C is superior to both natural rubber and SBR and is comparable with neoprene in this respect.

TABLE 8. AGED PROPERTIES AT ELEVATED TEMPERATURES. STOCKS AGED 8 HOURS AT TEST TEMPERATURE—ADIPRENE C, NR, AND SBR

Test temperature °F.	212	250	300	350
	Tensile Strength, Psi.			
Adiprene C	2050	1200	600	200
Natural rubber	2400	900	700	brittle
SBR (LTP)	1650	950	300	150
	Elongation, %			
Adiprene C	320	190	110	90
Natural rubber	430	270	410	brittle
SBR (LTP)	270	140	80	30

In Table 9 the low-temperature properties of Adiprene C vulcanizates are compared with natural rubber. While the low-temperature flexibility of Adiprene C vulcanizates is not equal to that of natural rubber, they do not become brittle even at −62° C. Low-temperature flexibility can be improved by compounding with ester plasticizers.

TABLE 9. LOW-TEMPERATURE PROPERTIES—ADIPRENE C AND NR

	Point of 10,000 Psi. Modulus (°C.)	Solenoid* Brittleness
Unplasticized natural rubber	−50	Broke at −62° C
Unplasticized adiprene C	−32	OK at −62° C
Adiprene C plus 15 pts. ester plasticizer	−44	OK at −62° C

* ASTM D 746-55T.

[11] RUBBER WORLD, Sept., 1947, p. 777; June, 1948, p. 367.

The resistance of Adiprene C vulcanizates to oxidation and ozone attack is excellent. Oxygen bomb aging comparisons are shown in Figure 8. The National Bureau of Standards strain test[11] was used here to permit the measurement of cumualtive effects. Since this is a non-destructive test, all measurements were made on the same specimen. The trend is toward an increase in elongation at constant stress, but the change is slight up to 14 days.

Adiprene C vulcanizates exposed to one ppm. of ozone under 20% elongation showed only trace cracking after 270 hours' exposure. Black stocks have good resistance to weathering; however, stocks containing Adiprene C discolor in sunlight, and its use in light-colored stocks is not recommended.

The resistance of Adiprene C to swell or degradation in commercial automotive or aviation fluids is excellent. Volume swell of an Adiprene C stock in various fluids is shown in Table 10. Adiprene C vulcanizates have good to excellent resistance to aliphatic, alicyclic, and terpene hydrocarbons, water, hydroxy compounds, and some halogenated compounds. They are not recommended for use in highly polar solvents and acids.

TABLE 10. ADIPRENE C—OIL AND FUEL RESISTANCE.

	% Volume* Change
ASTM No. 1 oil—70 hrs. at 100° C.	−2
3 oil—70 hrs. at 100° C.	29
Esso transmission fluid†—7 days at 100° C.	9
Reference Fuel No. 1‡—10 days at 25° C.	19
2‡—10 days at 25° C.	60
JP—5 Fuel§—7 days at 25° C.	18
Turbo Oil No. 15†—7 days at 25° C.	63

* ASTM D 471-55T.
† Standard Oil Co. of New Jersey.
‡ Phillips Petroleum Co., Bartlesville, Okla.
§ Air Force Specification MIL-F-5624.

Applications

The properties of Adiprene C immediately suggest its use as a tire elastomer, and this is expected to be the largest single market. In mechanical goods, its good balance of properties suggests a variety of applications such as conveyor belt covers, oil-well supplies, diaphragms, seals, and gaskets. The superior abrasion resistance of this polyurethane rubber coupled with its good heat aging and resistance to oxygen, ozone, and oil suggests widespread use in these fields.

Summary and Conclusions

In summary, we have in the polyurethanes a radically new synthetic elastomer type with outstanding physical characteristics. We feel certain that these properties will prove of great value in the future, and that within a few years the urethane rubbers will constitute a substantial volume of the synthetic rubber market.

Air Force Polymer Development Program[1]

By MAJOR WILLIAM POSTELNEK
Wright Air Development Center, Wright-Patterson Air Force Base, O.

The Air Force polymer development program on organic, semi-organic, and inorganic polymers during the past six years has resulted in new high-temperature and fuel- and oil-resistant elastomers.

Because of recent commercial developments in the field of fluorocarbon elastomers, the Air Force program in this area is being reduced, and the emphasis is now on inorganic polymers.

New polymers must be found which will exhibit more horizontal tensile strength-temperature slopes if elastomers stable at 750 and 1000° F. are to be developed.

POLYMER research effort on the part of Air Force contractors for the past six years has resulted in new high-temperature and fuel and oil resistant elastomers. In addition, independent industrial research programs have also come along to the point where the Air Force can derive a great deal of benefit from this work. Most of the new rubber compounds resulting from both programs will be described in detail in other papers presented at this conference.[2] For my part, I will discuss the current polymer program and future plans. The main areas of discussion will be as follows: (1) organic polymers; (2) inorganic or semi-inorganic polymers; (3) future considerations.

Organic Polymers

Our classification of organic polymers includes fluorocarbon polymers and fluoroalkyl silicones. The success which has been achieved in organic polymer development up to this point lies in the fact that we were able to draw upon more than 100 years of systematic progress in organic chemistry. By judicious tailoring of molecules to form thermally stable bonds, by selecting

TABLE 1. PROPERTIES OF RAW GUM KEL-F ELASTOMER 214

Molecular weight* (number average)	590,000
Tensile strength, psi.	530
Elongation, %	800
Hardness, Shore A, 5 sec.	49
Tensile retraction, T_{10}†, °F.	10
Tensile strength, after air aging (24 hrs. @ 621 °F.) psi.	230
Volume swell, 14 days at 300° F. in Esso #15‡, %	9
Volume swell, 7 days at 70° F. in SR 6§ fuel, %	2.5

* Osmotic pressure method.
† ASTM D 1329-54T, American Society for Testing Materials, Philadelphia, Pa.
‡ Esso Standard Oil, New York, N. Y.
§ A reference fuel consisting of 40% by weight of aromatics in iso-octane.

[1] Presented at the Joint WADC-University of Dayton Conference on Elastomers for Air Weapons, Dayton, O., March 27-28, 1957.
[2] See p. 529. Additional papers to appear in future issues.

The Author

Major William Postelnek, United States Air Force, is chief, polymer section, Materials Laboratory, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio. He attended Illinois Institute of Technology, from which he received a B.S. degree in chemistry, and Ohio State University, from which he received a Master of Science degree in organic chemistry.

After spending the period from 1946 to 1950 as a civilian industrial research chemist in Chicago, Ill., Mr. Postelnek joined the Materials Laboratory at WADC in 1951. He was made chief of the polymer section in 1955.

Major Postelnek's major fields of interest are organic synthesis, polymer chemistry, and fluorine chemistry. He is co-author of an American Chemical Society monograph on "Organic Fluorine Chemistry," to be published later this year.

He is a member of the American Chemical Society and the American Association for the Advancement of Science.

Major Wm. Postelnek

fluorine atoms and placing them in strategic positions, we were able to effect oil resistance and oxidative stability in an elastomer.

Kel-F-214

Under a jointly sponsored program with the Quartermaster Research & Development Command, M. W. Kellogg Co. has developed an interesting copolymer of perfluoropropene and vinylidine fluoride, which is similar to that of Du Pont's Viton A[3] in some respects.

The properties of the raw polymer are given in Table 1.

Some compounding studies were made by Kellogg and by WADC. Some data from this work by Kellogg are shown in Table 2.

TABLE 2. KEL-F ELASTOMER 214—PEROXIDE CURED COMPOUND

Recipe:	Polymer	100
	Zinc oxide	5
	Dyphos*	5
	Benzoyl peroxide	1.5
	LM-3 silica†	10
Cure:	Press, ½ hour at 300° F.; oven, 16 hours at 300° F.	

Properties:	Tensile	Hardness	% Elongation	Set at Break
Original	2405	55	405	20
70 Hours at 500° F.	1350	58	1000	30
550° F.	800	61	1050	30

* Dibasic lead phosphite, National Lead Co., New York, N. Y.
† Linde Co., Division of Union Carbide Corp., New York, N. Y.

Other curing systems were also investigated, including amine cures. More exploratory polymer work is being investigated by Kellogg in the area of fluorine-nitrogen or fluorine-oxygen polymers. Some of these systems are:

BASE

POLYETHERS:

$$CF_2=CF-CF_2-CH_2OH \longrightarrow \left\{CF_2-CFH-CF_2-CH_2-O\right\}_x$$

NITROSOMETHANE COPOLYMERS:

$$CF_3NO + CF_2=CH_2 \longrightarrow \left\{CF_2-CH_2-\underset{CF_3}{N}-O\right\}_x$$

AZOMETHINE COPOLYMERS:

$$R_FN=CF_2 + CF_2=CH_2 \longrightarrow \left\{CF_2-CH_2-\underset{R_F}{N}-CF_2\right\}_x$$

No progress on these systems has been reported to date, but if these systems can be polymerized, it is expected that extremely thermally stable polymers will result.

Hooker Fluorinated Polyester

Another polymer of interest is a fluorinated polyester rubber developed by Hooker Electrochemical Co. under Air Force contract:

$$\left[-OC(CH_2)_4CO_2CH_2(CF_2)_2CH_2O_2C(CH_2)_4CO-\right]_x$$

TABLE 3. HOOKER FLUORINATED POLYESTER—COMPOUND AND PROPERTIES

Polymer	100.0		
Carbon black	60.0		
Calcium carbonate	15.0		
DiCup*	22.0		
Physical Properties:	Original	70 Hrs. @ 350° F. MIL-L7808 Oil	168 Hrs. @ 400° F.- Air
Tensile strength, psi	2200–2400	1000–1330	940–1400
Elongation, %	125–225	150–175	150–175
Hardness, Shore A	70–80	64–69	75–78
Set at break, %	0–1	6–7	18–37
Weight loss, %		6	
Brittle point	−98° F.		
Freezing point	−71° F.		
Gehman stiffness†, T_{10}	−62° F.		
Temperature retraction, TR-10	−39° F.		

* Dicumyl peroxide, Hercules Powder Co., Wilmington, Del.
† ASTM D 1053-54T.

A typical recipe is shown in Table 3.

When only carbon black was used, good oil aging was observed; when only calcium carbonate was used as a filler, good air aging was observed. This recipe was a compromise in order to obtain good properties in both media. Presently, work is under way to use a mixture of dibasic acids with the fluorinated glycols in order to lower the temperature retraction value. Also being investigated are fluorinated analogs of nylon polymer which are elastomeric in nature.

Fluoroalkyl Silicone Polymers

Our previous work in the field of fluoroalkyl silicone polymers—first at Purdue University, then at Peninsular ChemResearch, Inc., and collaboration with Dow Corning—led to the development of Silastic LS-53.[4] Our present effort in this field is an attempt to incorporate more fluorine into silicone monomers and to study polymerization and copolymerization of these monomers. Some of the monomers under consideration are under the present contract with Peninsular and are as follows:

$$CH_3-\underset{Cl}{\overset{Cl}{Si}}-CH_2CH_2C_2F_5 \qquad CH_3-\underset{Cl}{\overset{Cl}{Si}}-CH_2CH_2C_3F_7$$

$$C_3F_7CH_2CH_2-\underset{Cl}{\overset{Cl}{Si}}-CH_2CH_2C_3F_7$$

It is expected that improvements in thermal stability and solvent resistance will result from this polymerization program.

Heteroatomic Fluorine Polymers

Work with a group headed by Dr. Dresdner at the

[3] RUBBER WORLD, May, 1957, p. 234.
[4] Dow Corning Co., Midland, Mich. See also our Oct., 1956, issue, p. 124.

University of Florida in conjunction with the Office of Naval Research is being pursued in the area of heteroatomic fluorine polymers. At this stage the thermal stability of numerous systems is being investigated, and recently work has begun on polymerization studies. The objective is to make a fluorocarbon polymer with a minimum of carbon-to-carbon bonds, or none at all.

The ideal system would be one such as:

$$\left\{CF_2\text{-}X\text{-}CF_2\text{-}X\right\}_N \qquad \text{WHERE } X = N, P, S, O$$

Previous work done at the University of Florida demonstrated the stability of such compounds as

$$CF_3SF_5 \qquad CF_3N{=}CF_2 \qquad C_2F_5OC_2F_5$$

were in excess of 500° C. Polymerization studies have already begun on perfluorodiamidines:

$$NC\text{-}(CF_2)_3\text{-}CN + NH_3 \longrightarrow H_2N\text{-}\overset{NH}{\overset{\|}{C}}(CF_2)_3\overset{NH}{\overset{\|}{C}}\text{-}NH_2 \xrightarrow{\Delta} \text{POLYMER}$$

Although these polymers are resinous in nature, they could possibly be modified to have elastomeric properties. Their thermal stability is indicated by the following results:

Aged in air, 12 hours @ 662° F.—1–2% wt. loss
24 hours @ 662° F.—2.5–3.0% wt. loss
6 hours @ 750° F.—17% wt. loss

Also, after reflux in concentrated nitric acid for one hour, no change was observed.

Inorganic Polymers

In contrast to the background which was available in the case of development of organic polymers, very little information was available in the field of inorganic polymers. The main objective of the Air Force program on inorganic polymers was to obtain some basic data on thermal stability of various prototype systems. The various polymer systems which have been and which are currently being investigated are:

(1)	–B–N–B–N–	Rutgers University
(2)	–P–O–P–O–	Rutgers University
(3)	–B–P–B–P–	American Potash Corp. and University of Southern California
(4)	–Si–O–B–	Aerojet-General
(5)	–Si–O–P–	Aerojet-General
(6)	–Si–O–Al–	B. F. Goodrich Co.
(7)	–P–N–P–	Naval Ordnance—Corona
(8)	Beryllium esters	University of Illinois

Of these systems, the boron-phosphorus and the nitrogen-phosphorus systems appear to be the most promising from a standpoint of attaining thermally stable elastomers. Work on some of the other systems has been phased out of the program. It should again be emphasized that these systems are being studied in order to obtain basic information on the inherent stability of various bonding systems. At the present time we do not have any polymers which can be considered as an elastomeric engineering material.

[5] General Electric Co., silicone products department, Waterford, N. Y.

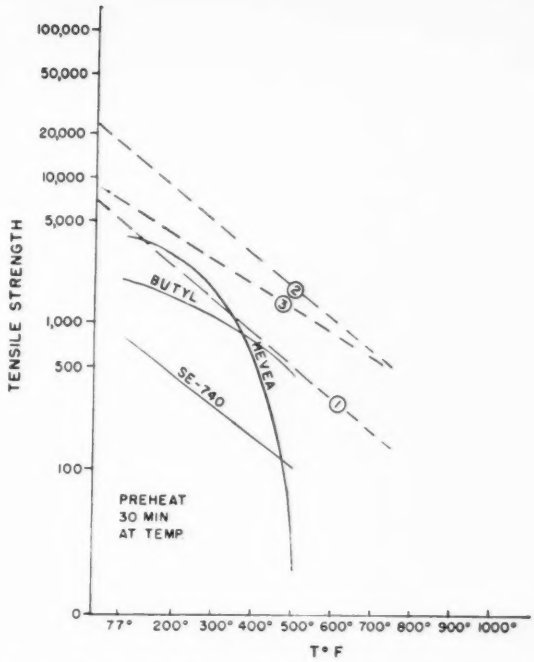


Fig. 1. Properties of some elastomers at high temperatures. Curves 1, 2, and 3 estimates of properties desired

Future Considerations

Since several new elastomeric polymers have been made available which exhibit good thermal stability as well as fuel and oil resistance and which can be utilized in aircraft for the next five years or so, increased emphasis is to be placed on new inorganic systems. Because of recent commercial developments in this field, Air Force-sponsored work on fluorocarbon elastomers is rapidly being phased out, although an effort in the field of heteroatomic fluorine-containing polymers will be continued as this class of materials appears to hold some degree of promise. A program has been initiated in the field of heterogeneous catalysis whereby means will be investigated to polymerize promising vinyl-type monomers which cannot be polymerized by conventional means. It is expected that high-temperature tire stocks might ultimately result from this program.

We are constantly appraising the possibility of attaining an elastomer stable to 750 or 1000° F. It is pertinent at this time to consider this possibility. Figure 1 summarizes some of the work done by Firestone Tire & Rubber Co. on an Air Force research contract studying physical properties of elastomers at high temperatures. Butyl rubber and SE-740,[5] a silicone compound, showed the best tensile-temperature slopes of all rubbers tested. Even at that, the resultant properties at 500° F. were rather poor.

If a minimum of 150 psi. tensile strength were desired at 750° F., the room temperature tensile strength would have to be about 4,800 psi. (curve 1). If 500 psi. tensile were required at 750° F., the room temperature

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MEETINGS and REPORTS

ASTM Committee D-11 and 22 Subcommittees Meet; Ozone Testing Symposium Planned

The annual meeting of Committee D-11 on Rubber and Rubber-Like Materials of the American Society for Testing Materials was held as a part of the Sixtieth annual meeting of the parent Society in Atlantic City, N. J., June 17-19. The D-11 Committee meeting was preceded by meetings of 22 of its 29 subcommittees and a meeting of its advisory committee.

This meeting of ASTM ended the term of office of R. A. Schatzel, Rome Cable Corp., and a member of Committee D-11, who has been president of the Society for the last 12-month period. The new president is Richard T. Kropf, vice president and director of research for Belding Heminway Co. and vice president and general manager of Belding Corticelli Industries, Inc.

Among the new directors of the Society and elected for a three-year term is A. E. Juve, director, technical services research, B. F. Goodrich Co. Research Center, and a member of Committee D-11 for many years.

Committee D-11 Meeting

The meeting of Committee D-11 was held on the morning of June 19, at which time a program of two technical papers arranged for by H. G. Bimmerman, E. I. du Pont de Nemours & Co., Inc., D-11 program chairman, were presented.

"Proposed IPCEA Specification for Dimensional Tolerances — IPCEA Project #356," by G. J. Crowdes, Simplex Wire & Cable Co., and chairman of Project #356, was the first paper given. Mr. Crowdes explained that IPCEA Project Committee #356 was organized almost five years to study tolerance limits on electrical insulation and sheath thicknesses, for the purpose of writing a more realistic specification than the one now in use. This group which consists of representatives from several manufacturers of wire and cable, has gathered measurements on insulation thickness from many manufacturers covering a production of approximately 75% of that of the whole industry. These data were accumulated for the purpose of determining the process capability of the industry and were limited for a start to rubber and thermoplastic insulation, made both by the extrusion process and the strip method.

The above-mentioned data from numerous manufacturers containing hundreds of measurements of 31 mil wall insulation showed that the process capability was approximately the same for all manufacturers and indicated that for a 31 mil wall a significant proportion of the production was below the specified minimum of 28 mils. The data indicated that wire having minimum insulation thickness as low as 23 mils may have been accepted by the present specification.

The IPCEA feels that since wire of the dimensions found has operated satisfactorily for many years, any new specification should be written to assure at least the present quality. A sampling plan should be written which will give assurance that the average wall will be 31 mils; the absolute minimum will be 23 mils, and this low reading should occur very infrequently.

After a study of the distribution of minimum wall, maximum wall, and average wall thicknesses for the 31 mil wall and other sizes, an IPCEA proposed sampling plan and specifications were written for an Acceptable Quality Level of 0.5%. After this new form of specification had been used for a six-month trial period, the IPCEA feels that it will provide a great amount of knowledge about the product for both the manufacturer and the purchaser, with a minimum amount of specification.

"Flexing Apparatus for Ozone Testing," by Dale J. Milnes, Mast Development Corp., was the second paper on the program. The determination of the ozone resistance of rubber compounds under dynamic rather than static conditions is becoming increasingly important, and Mr. Milnes first reviewed the various types and combinations of dynamic stressing considered desirable. Examples of various types of apparatus which have been used were described, including those of the Rock Island Arsenal, the National Research Council of Canada, Firestone Tire & Rubber Co., and Burke Research Co.

Mast Development questionnaired 50 companies interested in this type of ozone testing regarding the type of sample and the conditions of flexing desired. From the 26 replies received, the majority opinion was recorded, as follows: The sample was first desired rectangular in shape, but later suggested as a dumbbell-type specimen, 0.075- to 0.080-inch in thickness, with area exposed to ozone between land two inches. Location of clamps on the specimen should be not less than 1/2-inch from the area of ozone exposure, and the flexing desired was from initial flat unstretched condition to 20-30% extension and return. The apparatus should be capable of testing from 8 to 16 samples at once at 30-60 cycles per minute, and equal time intervals between the stretch cycles are desired.

Mr. Milnes then described the Mast Development apparatus developed for ozone testing of rubber compounds under conditions of dynamic flexing.

Simon Collier, Johns-Manville Corp., chairman of Committee D-11, presided at the regular meeting of the committee, assisted by J. J. Allen, Firestone Tire & Rubber Co., the secretary.

Mr. Collier announced the following new appointments: C. H. Seaberg, General Electric Co. liaison representative of D-11 with Committee E-11 on Quality Control of Materials and the *ad hoc* committee of IPCEA; Richard Bauman, B. F. Goodrich Co., D-11 representative on Committee E-10 on Radioisotopes and Radiation Effects; J. Macey, Goodrich, D-11 representative on Committee E-7 on Non-Destructive Testing; I. Drogin, United Carbon Co., D-11 representative on Committee D-24 on Carbon Black; and R. G. Seaman, RUBBER WORLD, chairman of D-11 subcommittee 8 on nomenclature and definitions.

The members were reminded of the meeting of ISO/TC 45 on Rubber to be held in New York from October 26 to 31, 1959, and the International Rubber Technology Conference to be held in Washington, D. C., November 8-13, 1959, and participated in jointly by the Rubber Division, ACS; the Rubber and Plastics Division ASME; and Committee D-11.

It was announced that new numbers for SBR as designated by B. S. Garvey, Pennsalt Mfg. Co., chairman of subcommittee 13 on synthetic elastomers, will be forwarded to the D-11 secretary, Mr. Allen, the ASTM headquarters, and the rubber trade journals for publicity purposes. These SBR code numbers will be reviewed at least once each year for publication in D 1419-56T, Description of Types of Styrene Rubbers (SBR), and in D 1420-56T, Description of Styrene Rubber (SBR) and Butadiene Rubber (BR) Latices.

The subcommittee chairmen were reminded that the scope of the work of their various subcommittees was to be reviewed and brought up-to-date.

Subcommittee Meetings

Subcommittee 5—Insulated Wire and Cable. John T. Blake, Simplex Wire, chairman. The results of a recent letter-ballot within the subcommittee on changes in present specifications were reported, and all items were declared accepted. It is recommended that they be adopted by Committee D-11, if a letter-ballot in the full committee is favorable.

It was agreed that the test section would continue to appraise methods for testing the corona level of cables. J. R. Perkins, E. I. du Pont de Nemours & Co., Inc., of Committee D-9 on Electrical Insulating Materials will keep in touch with the subcommittee 5 test section. Committee D-11 is requested to appoint C. W. Pickells, Consolidated Edison Co. of New York, Inc., for subcommittee 5 liaison with Committee D-9 on this subject.

A number of editorial changes in D 1350-56T, Specification for Construction of Insulated Wire and Cable, were suggested and adopted.

The subcommittee voted to ask Committee D-11 to assign to subcommittee 15 on Life Tests for Rubber Products the problem of specifying air-oven testing conditions to the extent that more reproducible results may be obtained.

Subcommittee 6—Packings. R. F. Anderson, B. F. Goodrich Co., chairman. A report on the stress-relaxation program in progress in subsection 10C of the SAE-ASTM Technical Committee on Automotive Rubber was made by H. G. Koch, Johns-Manville Corp. Round-robin testing indicates the need of uniform test apparatus to minimize the effect of spring in the fixture.

The subcommittee chairman reported on the status of the sealibility program in subsection 10C of the SAE-ASTM Technical Committee. Further round-robin testing is scheduled, with conditions of varying lock-up pressures and higher internal pressures to be investigated.

A corrosion requirement in D 733-53T, Methods of Testing Compressed Asbestos Sheet Packing, is considered desirable if a satisfactory procedure could be developed that would differentiate between materials and measure the extent of such corrosion. It was felt that such a requirement should be considered for materials covered by D 1170-54T, Specifications for Non-Metallic Gasket Materials for Automotive and Aeronautical Purposes. The matter is being referred to the chairman of subsection 10C of the Technical Committee.

The discussion of corrosion included some mention of O-rings, and in this connection, C. K. Chatten, New York Naval Shipyard, informed the subcommittee that the Bureau of Ships has developed a tentative specification for O-rings. Copies of this proposed specification will be furnished members of subcommittee 6 for comment.

Subcommittee 7—Rubber Latices. G. H. Barnes, Goodyear Tire & Rubber Co., chairman. A proposal by the Rubber Research Institute of Malaya to consider the fact that the present KOH number specification in D 1076-54T, Specifications and Methods of Test for Concentrated, Ammonia Preserved, Creamed and Centrifuged Natural Rubber Latex, of 0.80 is not adequate to cover certain low ammonia latices stabilized with preservatives such as boric and lauric acids, was discussed. The subcommittee does not feel that exchange should be made in this specification without further recommendations from W. G. Wren, of RRIM, and J. J. Allen, Committee D-11 secretary, was asked to so inform Mr. Wren.

A recommendation of the British Standards Institute for subsequent presentation to the ISO/TC 45 on Rubber at its meeting in September on a method of determining latex density, was also discussed. The subcommittee could see no advantages for the BSI method over the existing ASTM method since the apparent density of latex, as received, is of more value than is absolute density.

The subcommittee is revising the density Method A in D 1076-54T for submission to letter ballot. This revised method is capable of yielding an apparent density value for centrifuged latex. No satisfactory method is known for determining the apparent density of creamed latex. R. D. Stiehler, NBS, will communicate with the BSI on this matter.

The advantages of the "P" value test for latex was presented by John McGavack, United States Rubber Co. This test is a means of calculating volatile fatty acid content of a latex based on its water phase. Dr. McGavack will circulate the procedure among the members of the subcommittee for examination and comment.

Subcommittee 8 — Nomenclature and Definitions. R. G. Seaman, chairman. Draft Definitions for ISO Recommendations Nos. 48-53 of ISO/TC 45, Working Group 5 on Terminology of June, 1956, were reviewed in order to instruct the American delegation to the September meeting of ISO/TC 45 in Zurich, Switzerland. Certain suggestions for changes in these definitions were agreed upon and will be provided the American delegation in advance of its departure.

Subcommittee 8 plans to develop ASTM Tentative Recommended Practices for elastomer terminology based upon material in the recently published "Glossary of Terms Relating to Rubber and Rubber-Like Materials" and from other sources. Emphasis will be given also to terms in which ISO/TC 45 is interested.

Subcommittee 9—Insulating Tape. C. W. Pickells, chairman. Subcommittee 9 recommended to Committee D-11 the changes below in the proposed revision of certain specifications under its jurisdiction in order to resolve a negative vote returned in the recent letter-ballot on these specifications.

D 69-52T, Specifications for Friction Tape for General Use for Electrical Purposes:

Section 13: Add the word "average" before "thickness" and "width."

New Section 19: The last sentence of paragraph b shall read: "The purchaser reserves the right to reject the shipment if the second sampling fails to conform with the applicable requirement."

Section 26: In the last sentence, delete the words "and the maximum, minimum and average of these five measurements shall be reported," and substitute the words, "and the average of these five measurements shall be the average thickness and width referred to in Section 13."

D 119-48T, Specifications for Rubber Insulating Tape:

Section 8: In the first sentence add the word "average" before "thickness" and "width." In the second sentence delete the words, "nor the average length more than 5% in excess of it," and substitute the words, "and the average length of the rolls in any sampling shall not be more than 5% in excess of it."

Section 20: Delete from the last sentence the words, "and the maximum, minimum and average of these five measurements shall be reported," and substitute the words, "and the average of these five measurements shall be the average thickness and width referred to in Section 8."

D 1373-55T, Specifications for Ozone Resisting Rubber Insulating Tape:

Section 9: Change as recommended above for Section 8 of D119-48T.

Section 22: Renumber as Section 21 and in the last sentence delete "and the maximum, minimum and average of these five measurements shall be reported," and substitute, "and the average of these five measurements shall be the average thickness and width referred to in Section 9."

Subcommittee 10—Physical Testing. L. V. Cooper, Firestone, chairman. The chairman of the section investigating the possible variation due to the use of single or double spools on the clamps when testing O-rings, R. F. Tener, National Bureau of Standards, reported that although this work was not finished, no difference was apparent as yet in the final results, whether single or double spools were used, or whether the lower spool was power rotated or not.

The chairman of the task group investigating methods of determining equivalent cure, A. E. Juve, Goodrich Research Center, asked for more definite instructions on this assignment. It was revealed that the primary need was for translating the state of cure of very small articles to 1/10-inch tensile strength and 1/2-inch compression set slabs.

The chairman of the section on methods of calibration of the tension testing machine in D 412-51T, Tension Testing of Vulcanized Rubber, D. C. Scott, Jr., Scott Testers, Inc., reported that there was need of considerable study of the present calibration method since few, if any, users were employing the method as now written. A complete report was promised for the February, 1958, meeting.

The chairman of subcommittee 10 stated that the scope of Committee D-11 was being investigated and asked for suggestions in writing as to how this scope should be written at present. The wording of the D-11 scope given below was submitted to the advisory committee on June 5:

"Formulation of specifications, methods of test and definitions of terms pertaining to rubber and rubber-like materials, the compounding ingredients used therein and the products therefrom, including research concerning the properties of such materials and products.

"Rubbers are materials which are capable of a considerable degree of extension at room temperature, e.g., 50%, and which will retract forcibly and nearly completely when the extending force is released Although they are usually vulcanized or vulcanizable, this is not an essential requirement to be classed as rubbers.

"In practice there are two types of exceptions. The first exception is that the composition of materials readily recognized as rubber such as shoe sole materials, flooring, hard rubbers and cements, although they do not fit the above definition, are felt to be within the scope of this committee. The other exception concerns certain compositions which fit the above definition by acquiring rubber properties by virtue of the addition of plasticizers. These compositions such as polyvinyl chloride and its copolymers are not considered rubbers.

Subcommittee 11—Chemical Analysis of Rubber Products. W. P. Tyler, Goodrich Research, chairman. Results of a testing program for the determination of carbon black by the pyrolysis method showed good reproducibility and accuracy for compounds containing relatively low amounts of a variety of carbon blacks. More tests will be made on compounds containing higher loadings of carbon black and with mineral fillers also present.

Test results using a proposed absorptiometric method for the determination of zinc in rubber compounds showed excellent reproducibility and accuracy, also. This program will be extended to cover other types of compounds.

Test results from the use of the rapid extraction method for rubber compounds indicates the need of further study of this method. In principle the method appears promising.

A joint subcommittee 11 and 13 task group on the methods for determining mixed alkylated phenols in SBR reported favorable results.

The subcommittee ballot on the proposed method for melting range of rubber chemicals was reviewed. G. C. Maassen, R. T. Vanderbilt Co., provided arguments for proposing the method as a Tentative Standard Method despite the lack of reproducibility of the test results. A subcommittee letter-ballot will be conducted which will include requests for opinions on certain pertinent portions of this discussion. The subcommittee recommended publication of the report of this task group in the *ASTM Bulletin* after suitable changes agreed upon by the members of the task group and the editors of the *Bulletin* are made.

Preliminary amounts of standard samples for testing new sulfur determination methods are available. Several laboratories will test these samples using high-temperature combustion methods.

Subcommittee 12—Crude Natural Rubber. N. Bekkedahl, NBS, chairman. The subcommittee chairman reviewed the contents of his letter of May 10, 1957, to the members of this subcommittee, including the necessity of instructing the American delegation to the September ISO/TC 45 meeting on certain ISO/TC 45 documents dealing with matters in which the subcommittee was interested.

A representative of the General Services Administration presented the problem of mold growth on natural rubber in the government stockpile and asked for advice regarding its effects on rubber products made from such rubber. Mold on natural rubber is a part of the Rubber Manufacturers Association Type Descriptions and Specifications, and it was therefore suggested that GSA bring the problem first to the RMA since that organization has jurisdiction over such specifications. Any research project to determine the technical aspects of mold content on rubber products must originate with the government and/or the RMA. ASTM Committee D-11 will be glad to work on this problem, however, if asked to do so by the RMA or the government.

The National Bureau of Standards hopes to have a standard lot of natural rubber and a standard lot of mercaptobenzothiazole for testing natural rubber by the end of this year. The standard lot of natural rubber will be either #1 RSS or Liberian Crepe and will have properties in the range of the yellow grade of Technically Classified Rubber.

L. G. Mason, Goodrich, chairman of the task group on methods of test for natural rubber, reported that it now appears that a review of the existing methods of test and their use both in this country and abroad will be necessary in order to arrive at universally acceptable international standards.

In a letter from C. J. Glasser, Jr., Lee Rubber & Tire Corp., and liaison representative of subcommittee 12 on the RMA crude rubber committee, it was pointed out that higher than normal ash contents on recent shipment of Indonesian Ambers and Smoked Blankets had been found. Since there are no existing RMA or ASTM specifications for ash content, no complaint could be made officially, but it was suggested that subcommittee 12 needed to recommend ash specification limits as well as test procedures. The need of extremely rapid and accurate test methods was emphasized because of the limited time that imported natural rubber could remain on the docks after unloading before incurring extra charges for storage.

The need of improved test methods for natural rubber is paralleled by the need of an improved and statistically sound sampling procedure.

Copies of ISO/TC 45 documents 312, 313, 314, 315, and 316, will be made available to the members of the American delegation to the September ISO/TC 45 meeting by September 1, together with comments from subcommittee 12 on these documents, if possible.

Subcommittee 13—Synthetic Elastomers. B. S. Garvey, Jr., Pennsalt Mfg. Co., chairman. L. V. Cooper has resigned as secretary of this subcommittee, and I. D. Patterson, Goodyear, was named instead.

L. G. Mason, Goodrich, chairman of section 1, asked D-11 Secretary Allen for the results of the letter-ballot on the Proposed Tentative Methods for Sampling and Sample Preparation of Synthetic Elastomers (Solid SBR Copolymers), as it appeared in the D-11 preprinted report. There were 84 affirmative votes, five negative votes, and 91 not voting. Four of the negative votes were resolved by discussion, changing the final vote to 88 affirmative and one negative. W. M. Otto, Firestone; R. D. Stiehler, NBS; and J. I. Black, Shell Chemical Co., were asked to assist Mr. Mason in rewording the scope of the proposed sampling method and to prepare a footnote to emphasize that the sampling was at random and that the sample calculations were given under Volatile Matter Tests for purposes of clarification of the method and not as specifications.

Representatives of SBR black masterbatch and black-oil masterbatch producers and Mr. Mason are to recommend any additions and changes needed to cover sampling these types, as represented by SBR 1600 and SBR 1800, at the next meeting of subcommittee 13.

B. C. Pryor, Goodrich-Gulf Chemicals, Inc., chairman of section 2 on chemical test methods, reported on a test program among nine laboratories on the determination of alkylated phenol antioxidant in SBR 1006 and SBR 1502. Accuracy within laboratories and between eight of the laboratories was excellent, and the data will be submitted with a letter-ballot to subcommittee 13. F. J. Sackfield, American Synthetic Rubber Corp., submitted an alternate method for the determination of alkylated phenol antioxidant in oil masterbatches for the consideration of section 2.

Section 2 was requested to work toward the establishment of the former Federal Facilities Corp. test method for shrinkage as an ASTM test method.

The subcommittee voted to reestablish the section on physical testing in subcommittee 13, if consistent with the work of other subcommittees. Test methods for the physical testing of synthetic rubbers should be published separate for test methods for other rubbers and rubber products in the opinion of the majority of the subcommittee.

I. D. Patterson, chairman of section 4 on synthetic latices, reported that a letter-ballot in the section on the proposal to use isopropanol and phenyl beta naphthylamine as supplemental drying aids in the determination of total solids of SBR latices by D 1417-56T, Methods for Testing Synthetic Rubber Latices (SBR Copolymers), was defeated, and the change in method will not be made.

R. G. Seaman, chairman of section 5 on nomenclature, reported the following nomenclature and abbreviations for silicone rubber and certain members of this family of synthetic elastomers, in either dry or latex form.

Si—Silicone elastomers having only methyl groups on the polymer chain.

PSi—Silicone elastomers having both methyl and phenyl groups on the polymer chain.

VSi—Silicone elastomers having both methyl and vinyl groups on the polymer chain.

FSi—Silicone elastomers having both methyl and fluorine containing groups on the polymer chain.

PVSi—Silicone elastomers having methyl, phenyl, and vinyl groups on the polymer chain.

The subcommittee approved a retroactive letter-ballot in subcommittee 13 and in Committee D-11 to cover the inclusion of the definition and symbol Si of silicone elastomers and the definitions and symbols for certain members of this family of elastomers in D 1418-56T, Tentative Recommended Practice for Nomenclature for Synthetic Elastomers and Latices.

An attempt will be made in the near future to develop definitions and symbols for the polyurethane family of elastomers for D 1418-56T.

The subcommittee chairman reported assignment of SBR numbers to eight dry rubbers and latices, as follows: 1605, 1773, 1778, 1803, 1812, 2110, 2111, and 2112. The subcommittee voted to include these new numbers in D 1419-56T, Tentative Recommended Practice and Description of Styrene Rubbers (SBR), and D 1420-56T, Tentative Recommended Practice for Description of Types of Styrene Rubber (SBR) and Butadiene Rubber (BR) Latices. Future numbers will be assigned consecutively except for proposals to be submitted by Texas-U.S. Chemical Co. for SBR 1061 and SBR 1551.

Subcommittee 14—Abrasion Tests. R. F. Tener, chairman. The chairman of the RMA technical committee on heels and soles, A. I. Ross, American Biltrite Rubber Co., described the method of test for abrasion resistance of heels and soles as developed by his committee which employs the NBS abrader. Mr. Ross asked that the RMA method be considered for adoption by ASTM as a revision of D 394-47, Standard Methods of Test for Abrasion Resistance of Rubber Compounds, Method B.

Since the RMA method is somewhat restricted in scope, the subcommittee agreed to the preparation of a new method based on the RMA method; then this new method will be considered for use in D 394-47, in connection with a revision D 394-47.

The new method and the revision will be available for subcommittee consideration at its next meeting in February, 1958.

Subcommittee 15—Life Tests. G. C. Maassen, chairman. No meeting of subcommittee 15 was held, but the chairman reported that a revision of D 418-44, Method of Test for Resistance to Light Checking and Cracking of Rubber Compounds, was letter-balloted, with only three negative votes being recorded. These negative votes have been resolved. One of them requires an editorial change in the proposed revision to include that the observation for cracks in the rubber compound after exposure be made under a

A. E. Juve, ASTM director

7 power hand-glass, and it is recommended that this change be made in the revision.

Subcommittee 15 will present a symposium on ozone aging of rubber at the February, 1958, meeting of Committee D-11 in St. Louis, Mo.

Subcommittee 16—Description and Classification of Rubber Compounds. J. F. Kerscher, Goodyear, chairman. The chairman called attention to the change in the name of the subcommittee from "Classifications and Specifications for Rubber Compounds, to "Description and Classification of Rubber Compounds, and the change in the scope of the subcommittee, as follows: "To prepare a system for description and classification of rubber compounds for general use."

The two most recent proposals for description and classification systems for rubber compounds for general use are those of G. King, Yale Rubber Co., which was presented before the recent meeting of the Rubber Division, ACS, Montreal, P.Q., Canada, May 15-17, and the so-called "Expanded Tabular System," as worked out by SAE-ASTM Technical Committee, sub-section IV-D-3. The latter system consolidates into two large tables the basic property and suffix tables of D 735-55T, Specifications for Elastomer Compounds for Automotive Use. Other systems considered to date are the Dutch, the German, a modified D 735-55T system, and a system proposed by Warren Scoville, U. S. Rubber Co.

It was decided to ask Mr. Scoville to head up the task group to review all these systems, with special emphasis on the "Expanded Tabular System," and make a recommendation for a system for adoption.

It was pointed out that the reason for the work of subcommittee 16 was primarily to prevent the use of the tables in D 735-55T for purposes for which they were not intended.

ISO/TC 45, Working Group 6, documents 8 and 9 of February, 1957, were circulated by the chairman. Document 8 is a system for graduating properties of rubber compounds, as defined by ISO/TC 45/WG 6 document 252. Document 9 is an ISO draft for a specification system for vulcanized rubbers. Both documents 8 and 9 will be reviewed by the members of subcommittee 16, and comments are returnable to the chairman by July 31 in order that he may pass these comments on to the chairman of the subcommittee 16 task group.

Subcommittee 17—Hardness, Set and Creep. S. R. Doner, Raybestos-Manhattan, Inc., chairman. R. D. Stiehler, NBS, reported that the Wallace Co. of England is making an ISO hardness tester which, by purchase of an auxiliary unit, makes it suitable for taking hardness readings down to —70° C. NBS has ordered one of these units, and Dr. Stiehler will report on its use at the next meeting.

W. A. Frye, Inland Mfg. Division, General Motors Corp., reported qualitatively on the round-robin hardness testing program started in 1954. A final report based on a statistical analysis of the data will be made later.

A motion was approved to submit to letter-ballot in Committee D-11 the following changes in D 676-55T, Method of Test for Indentation of Rubber by Means of a Durometer:

"Alter sketch and paragraph c to change indentor extension tolerance from 0.100, +.000, —.010 of an inch, to 0.100, +.000, —.003 of an inch.

Alter note to read: "Previous to March, 1955, a great number of durometers were in use which had an indentor extension of 0.092 to 0.095 of an inch. A great number of specification values were necessarily based on readings with these durometers. The durometer as specified in this method will yield readings which vary linearly from 3 units higher at 30 to one unit higher at an indentation value of 90."

In February, 1957, a letter-ballot was circulated to the members of subcommittee 17 to determine whether D 314-52T should be advanced to standard or eliminated. The results of the 24 ballots returned were 10 for advancement to standard, 10 for elimination of the method, and four not voting. No action, therefore, was taken by the subcommittee.

W. F. Shore, Jr., Shore Instrument & Mfg. Co., Inc., described his current production of the Shore durometer which can be more easily adjusted.

Mr. Bachelder, Testing Instruments, Inc., demonstrated the latest model Wallace ISO hardness tester.

Subcommittee 19—Properties of Rubber in Liquids. F. H. Fritz, Du Pont, chairman. Dr. Stiehler reported on the status of fluid aging specifications in the ISO/TC 45 organization. Owing to lack of agreement between the various countries on these specifications, a new proposal is being drafted, which will be circulated in subcommittee 19 for comment later in the summer.

The report of the task group on the adequacy of D 471-55T, Methods of Test for Change in Properties of Elastomeric Vulcanizates Resulting from Immersion in Liquids, at temperatures of 250° F. and over, was tabled until the next meeting.

The need of new test fluids to take care of changing requirements in the industry was discussed, but it was agreed

that the time was not right for action in this area.

Changes in composition of ASTM #3 Oil was reported by one manufacturer of rubber products. The chairman will contact the supplier of this test fluid in this connection.

Subcommittee 21—Cements and Related Products. J. F. Anderson, Goodrich, chairman. The rapid method for the determination of the total solids of rubber cements, using the Cenco moisture balance, will be reported by Francis P. Canty at the next meeting.

The Chrysler-Bendix disk or block shear test for friction materials bonded to metals is being investigated in several laboratories, and, in general, improvements are considered to be necessary, particularly in the application of liquid cements and in obtaining even pressure during cure.

C. R. Lupton and A. J. Thomas, Bendix Products Division, Bendix Aviation Corp., described a test for bonds between friction material and automotive transmission bands which utilizes ultrasonic vibrations with Magniflux Corp.'s "Sonizone" apparatus as an effective means of detecting and recording failure points in a nondestructive manner. The Bendix representatives will write up the procedure, for consideration by the subcommittee. A previous method for determination of the bonds between friction materials and automotive transmission bands, identified as the "bend test," received six affirmative, one negative, and eight not-voting replies when circulated in the subcommittee. The ultrasonic method was offered as the explanation for the negative vote.

Subcommittee 22—Cellular Rubbers. H. G. Bimmerman, chairman. Tentative specifications and methods of test for polyvinyl chloride foam, Designation V, dated May 23, 1957, and tentative methods of test for flexible urethane foam, dated May 24, 1957, were discussed, and prompt comments in writing from members of the subcommittee were requested. If these comments are favorable as well as those from SAE-ASTM Technical Committee A, a letter-ballot in Committee D-11 on these methods is recommended.

A request that the dimensional tolerances in the appendices of D 1055-54T, Specifications for Latex Foam Rubbers, and D 1056-54T, Specifications for Sponge and Cellular Rubber Products, be incorporated in the main body of this specification resulted in a recommendation for letter-ballot in Committee D-11 on this matter. This same method of handling dimensional tolerances will be used in the future with polyvinyl chloride and polyurethane foams.

It was decided that the present methods of measuring cellular products were reasonably satisfactory, and no improvements were suggested.

A manufacturer of a foam indentation test machine has pointed out that other devices advertised for running this test differed in the method of loading. It was suggested that subcommittee 22 consider more complete specifications for this method of test. A revision of the wording on this test in D 1055-54T to include a speed of compression of ½-inch to 25 inches per minute will be prepared by C. S. Yoran, Brown Rubber Co., and L. A. Wohler, Firestone.

Subcommittee 22 has been requested to consider specifications for railroad journal lubricators made of cellular rubber. H. L. Goebel, U. S. Rubber, will work with J. J. Allen on this problem.

Mr. Lichtenstein, U. S. Army Signal Corps, requested consideration of an additional table of properties and specifications for silicone rubber sponge in D 1056-54T, and additional limits for the low-temperature R grade of expanded rubbers. It was recommended that he work with his suppliers and develop definite recommendations to submit to the subcommittee on these matters.

Subcommittee 23—Hard Rubber. W. J. Dermody, Stokes Molded Products, chairman. A negative vote in the recent D-11 letter-ballot on the proposed revision of D 530-55T, Methods of Testing Hard Rubber Products, which was based on a difference of opinion on conditioning time was reconciled and is now affirmative.

One of the two negative votes received on the proposed method of test for indentation of hard rubber by the type D Shore durometer was based on the differences between this method and D 676-55T, Method of Test for Indentation of Rubber by Means of a Durometer, and was reconciled by correspondence and is now affirmative. The other negative vote registered by Dr. Stiehler stated that the proposed new method introduces a new hardness scale that will introduce confusion in hardness testing and would nullify to a large extent the International Hardness Scale recently adopted by ASTM. It was also pointed out that the International Hardness Scale has the virtue of being adaptable to hard rubber as well as very soft rubbers by the simple expedient of expanding either end of the scale and could thereby provide a single hardness scale for all materials handled by D-11.

Subcommittee 23 considered Dr. Stiehlers objection, but feels that inasmuch as the method voted upon has been in widespread use for many years in the testing of both hard rubber and plastic materials and since there is available an abundance of data based on its use, adoption of the method does not comprise the introduction of a new scale, but rather the standardization of an accepted one which is in line with the aims of the Society. The subcommittee recommends to D-11 the adoption of the proposed method, with due note of Dr. Stiehler's objection.

The following editorial changes were recommended in connection with the proposed new methods for hardness measurement with the Shore type D durometer, which will be made: Change the word "Indentation" in the title to "Penetration." Clarify the wording in section 4 on temperature of test. Add the words "other than finished products" after "specimens in the last sentence of section 4b1 in order to clarify further the conditioning procedures. Delete the words "a minimum of" from the last sentence in section 5d.

Satisfactory progress in the round-robin test program aimed at revision of the falling weight impact in D 530-55T was reported.

D. E. Jones, American Hard Rubber Co., reported by letter on methods of water absorption and was appointed chairman of a task force to draft a proposed method of test for water absorption of hard rubber in line with the recommendations in his report.

Another task force reported that recommendations for a scheme of classification of hard rubber compounds will be available shortly.

There was no report on standardization from Committee D-20 on Plastics, but subcommittee 1 of D-20 has requested through the parent committee that it be granted joint jurisdicion with D-11 on D 676-55T.

Subcommittee 24—Coated Fabrics. K. L. Keene, U. S. Rubber, chairman. A reply to W. D. Appel, NBS, by the subcommittee chairman on the proposed method 5230 for Federal Specification CCC-5-191b was read, and in the discussion it developed that Du Pont at its Newburgh, N. Y., laboratory had a tester similar to the one described in method 5230. The tester is considered satisfactory for comparative testing, but not applicable for quality control testing because 30 days are required to obtain an end point. No members of subcommittee 24 had any experience with the method 5230 tester. The subcommittee considers that it has completed its work on this matter.

A letter from Daniel Smith, Interchemical Corp., and a member of Committee E-12 on Appearance was discussed, and it was decided not to initiate any work in this field at present.

The results of the subcommittee letter-ballot on the diaphragm burst tester for D 751-57T, Methods of Test for Rubber Coated Fabrics, were as follows: nine affirmative, one negative, and one not voting. This return was considered inadequate, and the matter will be submitted again to the membership.

W. H. Bryan, Du Pont, reported that he had 900 paired specimens representing a wide range of fabrics prepared for determining adhesion at two inches and 12 inches per minute. These specimens will be sent to seven members of the task group within the next three weeks, together with instructions, so that the work can be completed in time for the February meeting. All charts are to be returned to Mr. Bryan.

No report was received on the cold flexibility test. A report on an interlaboratory test on tack tear showed fair agreement between the four laboratories involved, but the agreement was not good enough to recommend the method as an ASTM tentative standard. The task group will make a further study to determine if the variations result from the test jig or the tensile test machine used.

The chairman proposed that the subcommittee initiate work on abrasion testing since the last work done in 1950 comparing the Wyzenbeck and the Taber testers was inconclusive. Mr. Bachelder, Testing Machines, Inc., volunteered to collect information on the various testing machines available for use with coated fabrics. It was voted to refer abrasion

testing of coated fabrics to the D-11 liaison representative on the ASTM Committee on Research as an unsolved problem.

Even though the number of laboratories using the dead-weight stretch test is limited, it was agreed that a task group be appointed because the dollar value of goods processed requiring this type of test is high.

Subcommittee 25 — Low-Temperature Tests. R. S. Havenhill, St. Joseph Lead Co., chairman. R. G. Dunlop, Smithers Laboratories, described a ball-thrust method of measuring the impact speed of the Scott solenoid tester for D 746-55T, Method of Test for Brittleness Temperatures of Plastics and Elastomers by Impact. By using 115 volts on the solenoid a velocity of 9.6 f.p.s. was obtained.

A task group under the chairmanship of Mr. Dunlop was appointed to determine the impact speed of several Scott solenoid machines using this method. The members of subcommittee 25 will be surveyed to determine the size of the test specimen.

The task group on the revision of D 1053-54T, Method of Measuring Low-Temperature Brittleness of Rubber-Like Materials by the Gehman Torsional Apparatus, headed by R. F. Ofner, Rock Island Arsenal, presented a revised draft of this method which was recommended for letter-ballot in D-11.

Irving Kahn, Ordnance Corps, U. S. Army, and Max Hanok presented data and comments on the use of a built-in foot, no foot, or a separate foot for the determination of low-temperature hardness. This information, which indicated somewhat irregular correlation, will be studied prior to discussion at the ISO/TC 45 September meeting.

The chairman reported no negative letter ballots in subcommittee 25 on the proposed additions to D 1329-54T, Method of Evaluating Low-Temperature Characteristics of Rubber and Rubber-Like Materials by a Temperature-Retraction Procedure. It is recommended that the following two sentences be added to the method, subject to letter-ballot in D-11:

Under "Testing Elongation," paragraph 6, at the end of the paragraph add: "In such studies,[4] crystallization of the long time conditioned specimens is indicated by the displacement of the TR curve toward the higher temperatures. Tests conducted at 50% elongation without previous long time conditioning[4] have been found to correlate fairly well with stiffness tests."

The above revision makes the present method more useful by adding an explanation of results obtained in studies using 50% elongation, which is already allowed in the present method.

Subcommittee 26—Processibility. Rolla H. Taylor, Scott Testers, chairman. John Ingmanson, Whitney Blake Co., D-11 representative on the ASTM Research Committee, extended an invitation to subcommittee 26 members to present unsolved problems in materials research.

J. S. Sweely, Sun Oil Co., in a letter to the chairman of subcommittee 26 recommended that consideration be given to the establishment of additional methods for evaluating processibility. A task group headed by Mr. Sweely and including W. Newlin Keen, Du Pont, and B. S. Garvey, Jr., was appointed to review this problem and report at the next meeting.

A proposal of R. D. Stiehler recommending revisions in D 927-55T, Method of Test for Viscosity of Rubber and Rubber-Like Materials by the Shearing Disk Viscometer, with the idea of making the method less restrictive was tabled without action at the request of the subcommittee.

ISO/TC 45, Document 311, second draft proposal for the Determination of Viscosity of Rubber and Rubber-Like Materials by the Shearing Disk Viscometer, and Document 316, for the Determination of Rate of Cure of Raw Natural Rubber in a Standard Compound by the Mooney Viscometer, submitted by the United Kingdom delegation to ISO/TC 45, were considered. The American delegation will be instructed to vote acceptance of Document 311, and that paragraph 3 of Document 316 relative to test temperature be revised to conform with the similar paragraph in D 1077-55T, Method of Test for Curing Characteristics of Vulcanizable Rubber Mixtures during Heating by the Shearing Disk Viscometer.

As a result of a proposal to revise D 1077-55T to include rate of cure and the subsequent discussion, a task group, consisting of Ross Shearer, Goodrich, R. H. Moon, and I. Drogin, was appointed to prepare a revision of D 1077-55T and also to combine with D 927-55T into one method, for consideration by the subcommittee and Committee D-11.

Subcommittee 28—Statistical Quality Control. E. M. Bader, Goodrich, chairman. Two task groups were appointed at the 1956 annual meeting. One was assigned the problem of reviewing all D-11 test procedures and evaluating the sampling methods contained in them. The other was assigned the problem of reviewing all D-11 specifications and evaluating the sampling procedures contained in them.

A report of the task force on specifications headed by J. I. Black was presented and indicates wide differences among the D-11 specifications in the treatment of sample sizes and sampling procedures. This task force will develop an outline of recommended treatment for sampling procedures for D-11 specifications.

Subcommittee 29—Compounding Ingredients. A. E. Juve, chairman. The proposed method for evaluating carbon blacks, which has been circulated in the subcommittee, was discussed, and since the criticisms of the method were relatively minor, it is recommended for letter-ballot in D-11. A proposal to incorporate the method in D 15-55T, Sample Preparation for Physical Testing of Rubber Products, although having the merit of avoiding duplication, was rejected since the users of the new method indicated preference for a separate method.

The D-11 letter-ballot on the proposed revision of D 15-55T resulted in three negative votes. One negative vote was resolved, and no action was taken on the other two. Numerous editorial changes were transmitted to the D-11 secretary, Mr. Allen.

Mention was made of the forthcoming availability of a standard sample of natural rubber and mercaptobenzothiazole, at the NBS. A new lot of reference standard NBS 38L, SBR 1500, will soon be required also.

It was proposed that a note be added to D 15-55T suggesting the use of a barrier film such as aluminum foil to prevent contamination of stocks during molding by materials deposited on the mold surfaces from previous cures.

SAE-ASTM Technical Committee A

H. Tangenberg, Goodrich, secretary of the SAE-ASTM Technical Committee on Automotive Rubber reported that this committee has approved the revisions in the silicone rubber tables of D 735-55T and SAE-10-R.

Changes have been made and approved on the following: (1) SAE-60-R for Standard Rubber Cups for Hydraulic Actuating Cylinders. (2) The addition of a procedure for the physical testing of Elastomeric Color Coatings to SAE-80-R Material Specification. (3) The addition of two wire braided types, C and D, and two sizes to SAE-40-R-2 Specification on Air Brake Hose. This change in SAE-40-R-2 necessitated the addition of a $^{3}/_{16}$- and $^{13}/_{32}$-inch size to ASTM D 622-55T, Methods of Testing Automotive Air Brake and Vacuum Brake Hose.

Several military specifications have been reviewed by the Hose, V-Belt, and Rubber Tables sections. The Automotive Gasket, Oil Seal and O-Ring sections have been very active on gasket and bench leakage tests and specifications. Besides modifying SAE-17-R and 18-R, in accordance with ASTM D 1055-54T and D 1056-54T, the Sponge subsection has been very active in the fields of new materials and polymers.

The Rubber Classification section has intensified its work on new polymers and designated new subsections on Impact, Adhesion, Tear, Flexing, and Latex Dipped Goods.

J. M. Ball, Midwest Rubber Reclaiming Co., has accepted the assignment of publicizing the activities of the Technical Committee. The high points of activity in the quarterly meeting are made available to the staffs of ASTM and SAE for their distribution.

ISO/TC 45 American Group

R. D. Stiehler, chairman of the American Group for ISO/TC 45, reported to Committee D-11 that the following methods have been adopted as official ISO Recommendations:

ISO/R33 Du Pont constant load method of measuring abrasion resistance of vulcanized natural and synthetic rubbers.

ISO/R34 Determination of tear strength of vulcanized natural and synthetic rubber (crescent specimen).

ISO/R35 Determination of the mechanical stability of latex.

ISO/R36 Method of testing the adhesion of vulcanized natural and synthetic rubbers to textile fabrics.

ISO/R37 Tensile stress-strain test of vulcanized natural and synthetic rubbers.

It is anticipated that the International hardness test will become an official ISO Recommendation in July, 1957. In addition, five draft ISO Recommendations pertaining to latex are now being letter-balloted by member countries.

The seventh meeting of ISO/TC 45 will be held in Zurich, Switzerland, from September 30 to October 5, 1957. The United States delegation will include the following members of the American Group: G. H. Barnes, H. G. Bimmerman, S. R. Doner, R. S. Havenhill, Irving Kahn, J. F. Kerscher, G. C. Maassen, and R. D. Stiehler. It is planned to have a meeting of the United States delegation in New York before the fall meeting of the Rubber Division, ACS.

The eighth meeting of ISO/TC 45 will be held in New York, N. Y., from October 26 to 31, 1959. This meeting will be followed by an International Rubber Technology Conference in Washington, D. C., from November 8 to 13, which will be jointly sponsored by the Rubber Division, ACS; the Rubber & Plastics Division, ASME; and Committee D-11 of ASTM.

R. G. Seaman replaced H. L. Fisher, retired, on the American Group for ISO/-TC 45.

Southern Group Meeting Features Two Symposia

Two symposia highlighted the third meeting of the Southern Rubber Group at the Dinkler Plaza Hotel, Atlanta, Ga., June 7 and 8, with registrants at the two-day session exceeding 225 members and guests.

The first symposium, on latex, was moderated by J. L. Fesperman, Catherine Rug Mills. The panel members and the subjects of their talks follow: E. Glymph, The Firestone Tire & Rubber Co., "Natural Latex"; J. P. McKenzie, Copolymer Rubber & Chemical Co., "Styrene-Butadiene Latex"; R. R. Waterman, R. T. Vanderbilt Co., "Latex Compounding"; and E. Leonard Borg, Naugatuck Chemical Division, United States Rubber Co., "Use of Latex in Textiles, Fibers, and Paper."

The second symposium, on antioxidants and antiozonants, was moderated by A. E. Huffman, Universal Oil Products Co. The panel members and the subjects of their talks were: T. H. Newby, Naugatuck, "Industrial Growth and Theory of Function"; D. E. Baker, Monsanto Chemical Co., "Use in Tires and Tubes"; J. C. Stewart, R. T. Vanderbilt, "Use in Latex"; A. R. Davis, American Cyanamid Co., "Use in Molded and Extruded Goods"; and C. E. McCormack, E. I. du Pont de Nemours & Co., Inc., "Use in Wire and Cable."

Mr. Glymph said in his talk that the future of natural latex is very bright because of advances in quality, yields, and production techniques, and the still superior physical properties of this latex over the synthetic type.

Dr. McKenzie stated that SBR latices will continue to increase in volume primarily because of the higher quality materials available from the low-temperature polymerization process. These latices are of larger particle size and produce films and foam with more strength than could previously be obtained with the high-temperature polymerization process.

Mr. Waterman discussed the equipment, raw materials, and procedures necessary for making a wide variety of latex products.

The concluding speaker in the latex symposium, Mr. Borg, described fabric adhesives, tire cord solutions, back sizing for rugs and pile fabric, along with the beater addition, saturating, and coating of papers and fibers.

The first speaker on the antioxidants and antiozonants panel, Dr. Newby, said that the degradation of rubber by oxygen is a free radical, autocatalytic chain reaction, and it is necessary to stop the chain reaction and destroy any peroxide already present. This action can be accomplished by very small amounts of correctly selected organic materials. He went on to describe degradation by ozone, a less understood process.

Mr. Baker in his paper described the use of antioxidants and antiozonants in the various types of tire construction and in tubes.

Mr. Stewart pointed out that most latex compounds must have non-staining, non-discoloring antioxidants. He described specifications for an ideal latex antioxidant which included ease in processing; freedom from staining, discoloration, toxicity, odor, and accelerating or retarding the cure on blooming; and resistance to copper deterioration.

Mr. Davis noted that saturated or nearly saturated polymers such as butyl, Hypalon, Thiokol, polysulfide rubber and silicone rubber normally do not require the use of antioxidants or antiozonants. He discussed the various types of commercial antioxidants, aldehyde amines, keytone-amine reaction products, secondary amines, primary aromatic amines, and phenols.

Mr. McCormack, the last speaker in this symposium, said that since insulations are normally protected by the outer covering, there is no need of antioxidant protection. Ozone generated by internal corona, however, does require antioxidant protection in high-voltage cable. Usually this is provided by a large percentage of factice and, to a much lesser extent, by antioxidants.

During the business session of the meeting election results were announced as follows: chairman, Tom Brown, B. F. Goodrich Co.; vice chairman, Warren Hall, Phillips Chemical Co.; treasurer, Monroe Mirsky, Guiberson Corp.; secretary, Roger Pfau, C. P. Hall Co.; and directors, Al Koper, Harwick Standard Chemical Co., and Robert Baker.

Functions of NBS, ASTM Discussed at Connecticut

The "significance and value" to the rubber industry of the National Bureau of Standards and the American Society for Testing Materials were discussed by R. D. Stiehler, National Bureau of Standards, Washington, D. C., and J. J. Allen, Firestone Industrial Products Co., Akron, O., before 125 members and guests of the Connecticut Rubber Group at Manero's Restaurant, Orange, Conn., May 24.

After outlining the organizational setup of NBS, Dr. Stiehler detailed the work of the Bureau, which he defined as "the science of measurement." An important but little heralded function of the NBS of lasting value to the rubber industry is the determination of physical constants and properties of rubbers and synthetic rubber monomers.

A second function is the development of testing methods and equipment. Examples of such developments are: the method used for measuring bound styrene in SBR polymers stemming from investigations on the refractive index of rubber; the strain test for the evaluation of rubber compounds, conceived during basic research on the stress-strain properties of rubber at various temperatures; and the current procedure for measuring the glass-transition temperature of rubbers and plastics.

Other tests were developed through the stimulus of work on federal specifications or at the request of another government agency. Examples of these include: the endurance test for tires now widely used in the tire industry; brake lining test; abrasion test; treadwear test for tires; and a test for aerological balloons.

A third function of NBS is the preparation of federal standards and specifications for testing rubber and rubber products and cooperation with such private organizations as ASTM, ASA, and ISO in the establishment of standards and specifications.

Mr. Allen discussed the history of the American Society for Testing Materials and the makeup of its technical committee D-11 on Rubber and Rubber-Like Materials which came into being in December, 1911. Today there are 29 sub-committees of D-11 whose work has so far resulted in 76 test methods and 26 product specifications.

Detailing the functions and achievements of D-11, Mr. Allen noted that in addition to revising existing methods, D-11 is constantly adding new test procedures. Generally, an attempt is made to fulfill the needs of the rubber industry as they arise, such as the recent publication of a Standard Glossary of Terms used in the industry, compiled by a sub-committee under the chairmanship of Harry L. Fisher.

Since the sale of the synthetic rubber plants to private industry, a new sub-committee 13 has been formed to keep abreast of synthetic rubber test methods and specifications, nomenclature, classification, and sampling.

To date, five of such tentative methods and recommended practices have been accepted by the ASTM: D1416, Methods for Chemical Analysis of Synthetic Elastomers, SBR Type; D1417, Methods for Testing Synthetic Rubber Latices, SBR Type; D1418, Recommended Practice for Nomenclature for Synthetic Elastomers and Latices; D1419, Recommended Practice for Description of Types of Styrene Rubbers (SBR); and D1420, Recommended Practice for Description of Types of Styrene (SBR) and Butadiene Rubber (BR) Latices.

A brief talk on membership in the American Chemical Society's Rubber Division was given by the Division's chairman, B. S. Garvey, Jr.

Papers on Tires and Aging at SAE June Meeting

Included in the program for the summer meeting of the Society of Automotive Engineers held in Atlantic City, N. J., June 2-7, were papers on high-speed tires, a method for the measurement of thump and roughness for quality control of passenger-car tire production, and a comprehensive survey of the status of accelerated testing of automotive rubber parts. Abstracts of these papers have been prepared and are given below:

Tires for High-Speed Operation. M. P. Hershey, Firestone Tire & Rubber Co., Akron, O.

High-speed driving produces rapid flexing of the tire and results in heat build-up. Heat is the major factor in tire deterioration. For a regular 7.50-14 size tire, at its maximum rated load and 24 psi. inflation, the tire tread temperature at 70 mph. is 215° F. As speed is increased, the tire temperature rises until at 100 mph. the temperature is 274° F. Maintaining tire running temperatures in the 250-270° F. range for an extended period of time causes a loss in tire properties and can result in a tread chunking or a separation condition. Also, the higher the load, the greater the heat build-up.

Between 100 and 250° F., tire compounds lose more than 40% of their tensile strength. These compounds have the ability of recovering most of their initial properties after short exposure to high temperatures, but long exposure gives permanent degradation. Long exposure also reduces adhesion of tire tread to the cord body.

One important factor necessary to secure good high-speed tire performance is adequate tire size. For a given load, best high-speed performance will be secured with a tire as large as is practical to use. For a given speed, the larger the tire, the less the revolutions per mile, and the cooler the tire temperature.

Another factor which is critical is inflation pressure. Tire tread temperature can be lowered by increasing inflation pressure. The higher pressure cuts down tire deflection and flexing, resulting in lower running temperature. The Tire & Rim Association recommends that for high speeds, inflation pressures should be increased four pounds above the inflation pressure shown in its published tables for normal speed operation.

A good high-speed passenger-car tire is one which is designed with a high-strength cord body which will withstand impacts, even with elevated inflation pressures and higher temperatures, is especially compounded to produce lower operating temperatures, and is designed to improve car handling at the higher speeds. The new Firestone "500" tire incorporates these features. It has a nylon cord body construction, incorporates high adhesion compounds, and is molded with a tread design to give excellent traction and car handling.

Nylon is generally being used in tires for improved high-speed performance. Nylon cords are lighter in gage even though they are much stronger than other tire cords, and the reduction in tire weight and bulk produces a lower tire running temperature. The cord is a very resilient and efficient material and does not build up heat during flexing of the tire. Nylon cord tends to shrink when hot, thus constricting the tread center circumferentially and allowing the tire to maintain a wider contact width with the road, which distributes the stresses more uniformly throughout the tire.

Another high-speed Firestone tire is the Super Sports, which has a racing-type six-ply nylon cord body. Compounds used in the cord body give excellent adhesion between plies plus low heat generation. The tread is compounded to give resistance to the abrasion-type wear of high-speed driving.

A Method of Measuring Thump and Roughness for Quality Control of Passenger-Car Tire Production. Frank Herzegh, The B. F. Goodrich Co., Akron.

The B. F. Goodrich Co., has developed a simple, accurate thump detecting device which is now being used in quality control of production passenger-rear tires. This device measures actual thump, gives reproducibility, presents easily interpreted data, and has a practical and dependable basic design. Essentially, it employs a method of studying the dynamic characteristics of a tire in the laboratory under conditions that simulate as closely as possible those which the tire encounters in service.

The device consists of a Cadillac frame complete with original front suspension set up with the back half of the frame cut off and attached to pivots. Shock absorbers are attached from the front of the frame to the floor to damp frame oscillations which, if present, cause variations on the tests results.

A velocity sensitive transducer, actuated by vertical movement of the suspension on which the test tire is mounted and running, produces a signal that indicates the severity of the tire thump or roughness. A most readily available, simple, and inexpensive transducer for this purpose was found in an ordinary five-inch round mass-produced permanent magnet speaker.

A light, rigid bar is attached to the frame (magnet) of the speaker; the upper end of the bar is fastened to the A-frame of the suspension as close to the wheel as possible. The frame from a discarded speaker is used as a support for the active speaker.

A container holding oil is then positioned under the suspended speaker so that the diaphragm is immersed in oil. The container is mounted solidly on the floor or other platform so as to be free from vibration. The speaker is immersed in SAE 30 viscosity oil to a depth of about three inches.

The diaphragm of the speaker is thus highly damped against resonance. Any movement of the speaker frame results in a movement of the coil attached to the diaphragm relative to the magnet, and a signal voltage is thus generated of a magnitude closely proportional to the velocity of movement of the A-frame.

The signal from the transducer is amplified. A cathode ray oscilloscope display of the signal information has been found to be satisfactory. A 35-mm. camera of the single-lens reflex type is permanently mounted before the cathode ray tube; the single-lens reflex design permits direct visual examination of the image, and, if desired, a photographic record is at hand.

The tire under test is mounted on the wheel of the test chassis, and the tire is then positioned so that some identifying mark around the periphery, (e.g., serial number) is directly over the road drum.

Since the thump with which we are concerned is not influenced or corrected by balance, a desirable feature for a laboratory test apparatus designed to detect thump would be to make its indications independent of the influences of unbalance. This feature would save the time required to balance the units to be tested. The procedure that meets this requirement is to test the units at low speeds, and this is followed in the Goodrich test procedure, the speaker said.

The thump value indications of the Goodrich machine are continually compared with road test results conducted by ride engineers and also by machine tests on tires returned from the field because of customer complaint. The correlation has been found to be satisfactory, and the machine results are accepted by production personnel as an indication of the quality of the tire. A test result, however, which is in agreement with the average of the ride engineers' judgments is at best all that can be expected of the machine.

Status of Accelerated Testing of Automotive Rubber Parts. W. J. Simpson, Chrysler Corp., Detroit, Mich.

Many types of accelerated aging tests have been developed and evaluated. Some of these are useful for research and development purposes; while others have found very practical application in qualification and control tests. The major contributions made in this field by the SAE-ASTM Committee on Automotive Rubber were mentioned.[1]

The effects of oxygen, heat, and internal reactions such as continued vulcanization on rubber products are those that air aging tests attempt to predict. Three types of chemical changes take place in the polymer: chain scission; cross-linking; and side group modification.

Chain scission is serious because it destroys the very polymeric nature of elastometers, a process called reversion. Cross-linking is accompanied by a lowering of elongation and an increase in stiffness and hardness of the vulcanized rubbers. Modification of side groups usually has little effect on tensile and elongation, but may change other properties such as oil and fuel resistance, electrical characteristics, etc., depending on the nature of the chemical groups modified.

Aging of rubber specimens in air at elevated temperatures under controlled conditions has been used for many years to predict the ability of rubber com-

[1] Society of Automotive Engineers Handbook and SAE Standards 10-R, 17-R, 18-R. American Society for Testing Materials' Standards on Rubber Products and ASTM Specifications D 735-55T, D 1055-54T, D 1056-54T.

pounds to resist deterioration by one or more of the above chemical changes. The oven tests now used are an outgrowth of the original Geer oven tests first announced in 1916. The method now most commonly employed is described in ASTM Designation D-573-53. For air aging at temperatures above 250° F., the test tube method (ASTM D 865-54T) or the cell-type oven method (E 95-52T) is recommended.

Other types of air aging tests are the oxygen bomb test, the air-pressure heat test, creep tests, and oxygen absorption tests.

It is now generally recognized that ozone is the main factor that causes severe weather aging of black elastomer compounds. One ozone weathering test is covered in ASTM Method D 1171-55. ASTM Method D 1149-55T describes the procedure for operating the Crabtree-Kemp type of ozone equipment and for analyzing the ozone concentration of the air mixture produced in the equipment. Also, both methods are being used together by some automotive companies.

Colored rubber parts when exposed to ultra-violet light can fade or discolor if the material in them is not properly compounded. ASTM Designation D 518-44 describes one method for exposing compounds to actual outdoor sunlight. ASTM Method D 750-55T describes the use and the control of the Fadeometer and Weatherometer, which have found wide acceptance.

Humidity aging tests are primarily valuable for urethane rubber, particularly the foam type. A rather lengthy 190° F. humidity aging test is expected to be replaced by a faster autoclave test at 220° F.

The most common method of conducting fluid aging tests is covered by ASTM Method D 471-55T. This consists of complete immersion of the part in such fluids as oils, fuels, coolants, hydraulic fluids, and others, for 70 hours at temperatures determined by the service that will be encountered. Immersion tests in actual fuels is employed to evaluate completely rubber fuel system parts.

For some fluid aging tests standard test fluids such as the ASTM oils are available. For others no standard test fluids are available, and the fluid in which the parts are used must be specified for aging tests. Work is now going on in both ASTM and SAE committees to develop more standard test fluids, and it is hoped that this effort can be expedited. Fluid aging tests can have a tremendous value in adequately controlling properties of parts that require resistance to aging in this environment.

In conclusion, it was emphasized that accelerated aging tests must be complete enough to predict the useful life of automotive parts in the environment in which they are used. On the other hand, it is advisable that an attempt be made to specify and control only the type of aging that is important to adequate function of the part, in order to prevent excessive material cost without sacrificing necessary quality.

Buffalo, Ontario Meeting Hears Polymer's Rowzee

E. R. Rowzee, executive vice president and manager of Polymer Corp., Ltd., Sarnia, Ont., Canada, addressed 306 attendees at the annual joint meeting of the Ontario Rubber Group and the Buffalo Rubber Group at the Sheraton Brock Hotel, Niagara Falls, Ont., May 10, on "Outlook on Rubber for Tomorrow—Technical, Economical, and Political."

Speaking on the technical and economic outlook, Dr. Rowzee expressed confidence that in the future this commodity should experience a more stable existence than has been the case in the past. On the basis of present rubber consumption trends, the year 1958 will see a surplus capacity of several hundred thousand tons of synthetic rubber, which should lead to greater price stability.

Pointing out that until recently synthetic rubber producers have countered rising costs by increases in productivity as a result of technological advances, Mr. Rowzee cautioned that the industry could no longer guarantee the maintaining of the present price structure indefinitely.

Synthetic rubber plants being built in Europe should not reduce the size of the export market of North American synthetic rubber producers. Synthetic rubber consumed in Western Europe increased from 12% in 1955 to nearly 19% in 1956, and present indications are that this figure will reach 25% in 1957. If world rubber consumption increases as expected, and if natural rubber production remains at its present level, then European and other countries will have to consume about one-third of their total new rubber as synthetic during the next three years, it was said.

The commercial availability of synthetic polyisoprene rubbers was put "several years" into the future, even though the world expenditure for research on these elastomers in 1956 totaled $50 million. Polymer Corp., like other companies, is giving increased attention to the new field of polymerization catalysts which are expected to find application in the manufacture of plastics and fibers, besides rubber.

On the future of existing synthetic rubbers, Mr. Rowzee singled out butyl as showing particular promise. In 1956, Canadian consumption of butyl in non-transportation products amounted to less than 10% of its output. This year the figure will be about 25%. Mr. Rowzee called the outlook for butyl in automobile tires a "controversial subject."

Commenting on the general prospects for Polymer Corp., Mr. Rowzee said that rubber production there during 1956 totaled 120,000 tons and is expected to reach 150,000 tons or better in 1959. To reach that figure, however, it will be necessary to introduce additional butadiene production capacity, since this basic raw material has not kept pace with the increases in synthetic rubber production. He said plans were almost finalized for the construction in Alberta of a butane-based butadiene plant to cost more than $15 million.

More Than 200 Attend New York Group Outing

The New York Rubber Group held its annual summer outing at Doerr's Grove, Millburn, N. J., June 6, with more than 200 members and guests in attendance. Under a sunny sky, a variety of sports activities continued throughout the day.

Ernest Holstrom, American Biltrite Co., took top honors in the golf contest. A. G. Zerillo, Zerillo Products, Inc., came out first in the baseball throw; while J. McQuine, of the same company, led the field in the basketball throw. A team captained by Jack Briggs, Esso Research & Engineering Co., won the day's major softball game.

R. J. Reale, Pitt Consol Chemical Co., and Bill Hartmann, Laurie Rubber Reclaiming Co., made up the afternoon's best bocci team. First and second places in the horseshoes contest went to W. Lamela, Okonite Wire & Cable Co., and O. B. Samler, R. T. Vanderbilt Co., respectively. G. E. Serniuk, Esso Research, won the darts competition, with Miles Olsen, Niagara Rubber Corp., runner up.

R. B. Carroll, R. E. Carroll, Inc., was chairman of the committee in charge of arrangements, being assisted by Al Gessler, Esso Research; Dick Glidden, Ames Rubber Corp.; Ralph Ambrose, Rodic Chemical & Rubber Corp.; Roy Benfer, Dow Corning Corp.; W. Lamela; K. Chester, C. P. Hall Co.; and George Wyrough, Wyrough & Loser. R. Seaman and M. Zelenko, RUBBER WORLD, and C. Jansen, *Rubber Age*, held sway in the ticket shack.

August 1 is the date of this year's golf outing to be held at Baltusrol Golf Club, Springfield, N. J. Lester J. Koch, Westwood Chemical Co., is in charge of this affair.

The Group's Christmas party will be given at New York's Latin Quarter on December 13 and will be stag, it was announced by Herbert Due, St. Joseph Lead Co., chairman of the Group.

Paraflint Use Seen Rising

The great acceleration in polyethylene production will in turn expand the market for synthetic paraffin, it was forecast by Moore & Munger, New York, N. Y., sole distributor in the United States and Canada of Paraflint, a South African synthetic paraffin largely used as a strengthening agent for linear polyethylenes.

Paraflint blends easily into polyethylene and makes it stiffer and less permeable without materially weakening the plastic, the company says.

Combinations of the two materials are being employed in the manufacture of a variety of plastic containers, kitchen equipment, toys, and dispenser "squeeze" bottles.

The paraffin is also expected to find application in the manufacture of electric potting compounds, asphalt and rubber compounding, solvent and paste-type polishes, printing inks, carbon papers, paints, and varnishes.

Rubber Division Goodyear Medal to A. W. Carpenter

Arthur W. Carpenter, Akron, O., consultant on rubber technology and former manager of the testing laboratories of The B. F. Goodrich Co., has been selected to receive the Charles Goodyear Medal of the Division of Rubber Chemistry of the American Chemical Society.[1] Mr. Carpenter will receive the award at the meeting of the Division in New York, N. Y., September 10-13.

The Goodyear Medal,[2] commemorating Charles Goodyear's discovery of vulcanization in 1839, is conferred annually by the ACS Rubber Division "to a person who has made a valuable contribution to the science or technology of rubber or related subjects."

An outstanding authority in his field, Mr. Carpenter is well known in the rubber industry for his important contributions to the development of methods and means of testing rubber and rubber products.

The Medalist was graduated from Massachusetts Institute of Technology in 1913 and received an M.S. degree in chemical engineering there the following year. He was a city chemist in charge of the water purification plant at Alliance, O., and then assistant superintendent of the Akron water purification plant until he joined the United States Army in 1918. He became a captain in the Sanitary Corps in France.

A rubber technologist and compounder with the Goodyear Tire & Rubber Co. for six years, Mr. Carpenter next was factory superintendent of the Holtite Mfg. Co., before joining Goodrich as a development engineer in 1927. He became manager of the Goodrich testing laboratories in 1928 and remained there until he retired in '55.

On loan to the government from Goodrich during World War II, the Medalist served as consultant to the War Production Board and assistant director for raw materials of the National Security Resources Board. On returning to industry after the war he received the NSRB Distinguished Services Award in recognition of his outstanding contributions to the work of the Board and his devotion to the welfare of the country.

Arthur W. Carpenter

Mr. Carpenter has been active in the administration and committee work of the American Society for Testing Materials since 1928 and was president of that Society in 1947. In addition to being an active member of the ACS and the ASTM, Mr. Carpenter is a Fellow of the American Institute of Chemists and a member of the American Institute of Chemical Engineers and the National Society of Professional Engineers.

[1] RUBBER WORLD, June, 1957, p. 394.
[2] *Ibid.*, Jan., 1956, p. 533.

Northeast Section Group Presents Short Talks

The sixth annual Short Talks Symposium of the Elastomer & Plastics Group, Northeastern Section, American Chemical Society, was held at Science Park, Boston, Mass., May 21, with Victor S. Frank, Dewey & Almy Chemical Division, W. R. Grace Co., presiding as chairman.

The speakers were George Kovach, Foster Grant Co., Inc.; George E. Stevenson, Weymouth Art Leather Co.; Edward R. Atkinson, Dewey & Almy; Seymour Rothchild, New England Nuclear Corp.; and John P. Bowen, U.B.S. Chemicals.

Taking for his topic "Applications of Nylon-6" Mr. Kovach listed the following properties for the material: controllable toughness and high elongation, very high heat resistance, very high surface hardness, extremely low coefficient of friction, and outstanding chemical resistance to petroleum products and to alkalies and acids of medium concentration.

Applications of the nylon, therefore, were said to be ships' propellers, automotive products, hospital equipment, movie cameras, business machines, and electrical parts and housings, among other items.

Mr. Stevenson, speaking on "Recent Developments in Plastisol Technology," considered the three types of plastic suspensions in use: aquasols, having high surface tension and dilatant viscosity; organosols, with medium surface tension and thixotropic viscosity; and plastisols, with low surface tension and pseudoplastic and thixotropic viscosity characteristics. The temperature and viscosity requirements of each application were said to control the type of suspension to be used.

Plasticizers, stabilizers, and chelating agents and epoxy binders were also discussed.

Dr. Atkinson spoke on "Polyamide Chemistry," describing the condensation reactions by which polyamides are formed and the infinite number of polymers that are possible. The reversibility of these reactions and the mechanism of property control through variation of chain length between polar groups were discussed. The starting points and the resulting properties of each of the six more common nylons and General Mills' Versamids were detailed.

"Applications of Radioactive Tracers in High Polymers" was the subject of Dr. Rothchild's talk. The relative simplicity and the low cost of tracers in chemical process and product examination were indicated. Free radical addition to aromatic nuclei in the vinyl acetate polymerization process, using C^{14}-labeled benzene was described as one application of radioactive tracers.

The rate and the amount of benzoyl peroxide incorporation into styrene polymer have also been examined, and the decomposition of the peroxide has been determined by measurements of radioactivity in the evolved gases.

Other applications detailed were the following: examining permeability of elastomeric films to moisture through tritium-labeled water; checking plasticizer migration in polymeric food wrappings by means of tagged plasticizers; and making mold erosion studies by utilizing tagged molding powder and measuring the total activity in successively molded parts.

Mr. Bowen, discussing "A Practical Approach to the Formulation of Adhesives and Finishes," described a method developed to reduce the number of experiments necessary to evaluate the various possible combinations of ingredients in any formula under study to thirteen.

The technique involves the selection of three major ingredients, with all other ingredients distributed into the three as convenient. Two components are combined in ratios of their sum, reducing the system to two actual coordinates: these ratios and the third component.

With five ratios of the two components, and five quantities of the third component, expressed in percentage, and by skipping adjacent possibilities throughout the plan, thirteen combinations for testing result. Minor adjustments of the best formula complete the test plan.

Sixth Annual Golf Outing Held by Fort Wayne Group

The Fort Wayne Rubber & Plastics Group held its sixth annual golf outing at Tippecanoe Country Club, Leesburg, Ind., June 7, with the 283 members and guests in attendance competing in the golf tournament as well as in other athletic activities.

Richard Rieger, Bakelite Co., top golfer of the day, with the low gross of 75, won golf trophies presented by Goshen Rubber Co. and Jasper Rubber Co. John Gordon, General Electric Co., was runner-up.

The prize in the long-drive competition went to Morris Keyser, Rohm & Haas Co., while that in the closest-to-the-pin tournament was awarded to Robert Kann, Goodyear Tire & Rubber Co., with Walt Wilson, R. T. Vanderbilt Co., second.

Other golf prizes were won by: Ray Mitchell, Extruded Plastics; Norm Rose, Triangle Rubber Co., Inc.; Don Zimmerman and Wm. Poure, United States Rub-

ber Co.; F. Steitz, J. M. Huber Corp.; Dan Lamb, Oakite Products, Inc.; Dan Chovan, Witco Chemical Co.; Don Wogoman, Mogul Rubber Co.; F. Frost, Frost Rubber Works; Cal Ihrcke, Kitco Engineering & Mfg. Co., Inc.; William Harrison, General Tire & Rubber Co.; Cal Yoran, Brown Rubber Co.; Russ Kurtz, E. I. du Pont de Nemours & Co., Inc.; and William Johnson, Goshen Rubber.

John Porter, H. Muehlstein & Co., Inc., chairman of the outing committee, was assisted by John Lawless, du Pont; Jack Lippincott and Ed Theall, Dryden Rubber Division; Charles Cougill, Auburn Rubber Co.; Stan Shaw, Witco; Wm. Poure; Al Robinson, Harwick Standard Chemical Co.; Tom Saputo, Latex Compounders, Inc.; and Howard Cantwell, U. S. Rubber.

George Kelsheimer, U.S. Rubber, was announced as the newly elected chairman of the Fort Wayne Rubber & Plastics Group. Phil Magner, Jr., General Tire, is vice chairman, and Walt Wilson, secretary-treasurer.

R. I. Club Golf Outing

Ideal weather attended the Rhode Island Rubber Club's summer outing and golf tournament at the Pawtucket Country Club, Pawtucket, R. I., June 6. Present were 280 members and guests.

C. T. Lyons, Rubber Corp. of America, scored first low gross for the day, with W. A. Maguire, United Carbon Co., second, and W. King, secretary-treasurer of the Boston Rubber Group, third. First three positions among the winners of the blind bogey contest were R. Babbit, R. T. Vanderbilt Co.; H. D. Dietrich, General Magnesite & Magnesia Co.; and E. Jacoby, J. A. Baybott Co.

Longest drive was achieved by W. E. Stone, Kleistone Rubber Co. In the putting competition, S. Trykowski, Wm. Brand & Co., took top honors. J. Jacinto, Collyer Insulated Wire Co., and S. Szulik, Acushnet Process Co., were runners-up. A. Navarette, Kaiser Aluminum Corp., and R. Szulik, Acushnet Process, won prizes in the nearest-to-the-pin tourney.

Most 7's and 8's were reaped by C. W. Grubb, Witco Chemical Co., and J. Edenbaum, Davol Rubber, respectively. Highest gross was recorded by J. Donahue, Goodyear Tire & Rubber Co.; while highest net was made by F. Catalfano, Bristol Mfg. Corp.

Top Golfer in RTA

Paul A. Mulach, a sales executive with Baird Rubber & Trading Co., Inc., New York, N. Y., has won the 1957 William T. Baird Trophy, emblematic of the golf championship of the Rubber Trade Association of New York.

Mr. Mulach, who previously won the trophy in 1955, carded a 79 at the Knollwood Country Club, Elmsford, N. Y., June 10, during the annual RTA outing.

Record 660 Attendance at Boston Group's Outing

A record turnout of 660 members and guests attended the Twenty-First annual outing of the Boston Rubber Group at the Andover Country Club, Andover, Mass., June 14.

Golf tournament director Lyle Longworth, Monsanto Chemical Co., supervised the 18-hole and nine-hole golf competitions, computing winners through the Calloway handicapping system.

In the 18-hole contest, J. Simpson, Hodgman Rubber Co., achieved lowest gross; while G. Acker, a guest, took low net honors. Placing first in the kickers handicap was W. Connery, Industrial Solvents & Chemical Co. P. S. Manchester, Union Carbide & Carbon Co., was nearest to the pin, and J. Nolan, Firestone Rubber Co., scored most 6's. Highest gross and highest net were totaled by M. F. Perdigao, Godfrey L. Cabot, Inc., and D. Flagg, American Mineral Spirits Co., respectively.

The following golfers scored in the nine-hole contest: J. Blonstrom, General Latex & Chemical Co., low gross; E. C. Mack, General Latex, low net; R. Wittenaur, high gross; R. Cummings, high net; and J. Kearns, Warwick Chemical Co., and R. Ross, Sessions-Gifford, Inc., first and second in the kickers handicap. The putting contest was won by Frank Ward, American Biltrite Rubber Co.

Top honors in other games went to Al Ryan, Raffi & Swanson Co., tub and ball game; R. E. Leeds, Taylor Instrument Cos., darts; and Philip Blanchard, T. C. Ashley Co., and Ed Weber, retired, horseshoes.

James J. Breen, Barrett & Breen, was chairman of the outing committee and was assisted by George E. Herbert, Tyer Rubber Co., and Harry A. Atwater, retired. Game directors included James H. FitzGerald, Harwick Standard Chemical Co.; Henry Anthony, Tyer Rubber; R. A. Herthel, Hood Rubber Co.; Joseph Cullen, Marbon Chemical Division; and Russell Edwards, Stedfast Rubber Co.

Correction

In our report of some of the papers given before the first Joint Rubber Division Conference, Montreal, P.Q., May 15-17, 1957, as reported in the June issue of RUBBER WORLD, the following comments were made on the paper entitled, "Lignin as a Reinforcement for SBR in Military Pattern Tires," by Lloyd Krichew, Canadian Department of National Defense, and others:

"When compared with carbon black reinforced SBR compounds, the lignin compounds indicated lower heat build-up and greater resistance to cracking with somewhat higher abrasion losses. Military truck tires using lignin compound for treads showed good crack resistance and wear properties when tested on a gravel course. . . ."

Mr. Krichew feels that this report implies that SBR-lignin tires, under road service conditions, did not wear so well as the carbon black controls and also that the lignin's tread crack resistance was shown to advantage.

"As reported in the referenced paper," he says, 'the road test results contradicted the laboratory findings since the lignin tires were superior in tread wear resistance (15%) while the cutting resistance of six of the eight tires road tested were poor compared with the carbon black control tires."

Philadelphia Group Text

The Philadelphia Rubber Group is making available a second printing of its book, "Basic Rubber Technology," which is a compilation of 15 lectures making up the organization's annual rubber technology course.

In addition to coverage of the types of natural and synthetic rubbers, the text includes chapters on vulcanization, reinforcement, antioxidants, softeners and plasticizers, extenders and peptizers, testing and testing equipment, latices and foam rubber, and compounding instructions.

The books may be obtained from A. J. DiMaggio, The Firestone Tire & Rubber Co., Pottstown, Pa., at $5 a copy.

ASME Elects Secretary

Oscar B. Schier, II, has been designated secretary-elect of the American Society of Mechanical Engineers by unanimous vote of the Society's council, succeeding Clarence E. Davies, who has retired after 23 years of service in this office. Secretary is chief administrative office of the 50,000-member organization.

Mr. Schier, 49, has been a member of the Society since 1932 and a member of the staff in various capacities for the past 11 years. He was formerly associated with Consolidated Edison Co. of New York.

More Chemicals To Be Made

Monsanto Canada, Ltd., Montreal, P.Q., Canada, will begin in the early fall production of such accelerator and antioxidant chemicals as Santocure and Santoflex AW at its Ville LaSalle plant, near Montreal. At the present time a large percentage of the chemicals supplied to the rubber industry in Canada is imported.

The company is undertaking the production of rubber chemicals to assure a steady supply and rapid delivery of these products to a growing Canadian rubber industry, according to Leo E. Ryan, president of the Canadian firm.

It is also felt that in this way Monsanto's research facilities in Canada will be of more direct use to rubber producers in working out new chemicals and processing techniques, he further declared.

RAYMOND BILL

Raymond Bill, president and board chairman of Bill Brothers Publishing Corp., passed away peacefully in his sleep Thursday morning, June 13, at his Greenwich, Conn., home. There had been no previous illness. He was in his sixty-first year.

Among the publications and organizations which he headed were *Fast Food*, *Floor Covering Profits*, *Grocer-Graphic*, *Plastics Technology*, *Premium Practice*, RUBBER WORLD, *Sales Management*, *Sales Meetings*, *Tide*, *Tires-TBA Merchandising*, *Yankee Grocer*, and Market Statistics, Inc.

After graduation from the University of Wisconsin in 1916, he joined the publishing firm founded by his father, Colonel Edward L. Bill, before the turn of the century. Under his leadership the organization has become one of the larger and more successful publishers of business magazines.

At the time of his passing he was vice chairman of National Business Publications, Inc., chairman of Sales Promotion Executives Assn., a director of Magazine Publishers Assn., and an officer and director of several other publishing companies.

Back in the early Thirties he sensed the need of both local clubs and a national association of sales executives and was the prime organizer and first elected president of National Sales Executives, Inc., now a leading national and international association with 28,000 members and 211 affiliated clubs. In more recent years he helped sales promotion executives to form a similar national body.

In World War I he enlisted in the U. S. Navy and in subsequent years served the government in many capacities, such as acting as first chairman and current head of the advisory committee of the National Distribution Council of the Department of Commerce. He was a former president of the National Conference of Business Paper Editors, former board chairman of Bolde & Horst Co., for many years a director of RKO Pictures and a suburban bank. His was a rich, active life.

A striking facet of his personal and his business philosophy was well summed up in these excerpts from an off-the-cuff talk he made before the associates of Bill Brothers in a March meeting at the Hotel Vanderbilt, New York:

"Ours is and always will be primarily a business of people. Ours is a business where the homely virtues, including fear of God, long-term loyalty, personal strength to control human weakness and defeat temptation, count most.

"All this adds up to good character—good all-around character—out of which is born the gracious kind of friendliness and the love of fellow man, which is the gospel of all religions. In other words, what goes best for the individual also goes best for the company and—*vice versa*. If we all, from top to bottom, proceed in this spirit and with this conviction, our future surely will be bright—and happy."

In a very real sense he was an outstanding pioneer in raising the sights and setting ever-higher standards in business paper publishing, and his contributions went far beyond Bill Brothers.

Even more important perhaps than these efforts to increase the stature of publishing was Ray Bill's ceaseless, even youthful, dissatisfaction with the present. His inquiring mind was ever receptive to new ideas, new ways of doing old things, to experiment, to daring projects and daring thinking.

Mr. Bill is survived by his widow, Mrs. Raymond Bill, of Greenwich, Conn.; his sister, Mrs. Randolph Brown, of Lyme, Conn.; his daughters, Mrs. Robert Neely, of New York, and Mrs. John Hartman, of New Canaan, Conn.; and two grandchildren, Lee Martin Bill Hartman and Raymond Bill Hartman.

NEWS of the MONTH

Washington Report and National News Summary

. . . Agriculture, Treasury, Commerce, Army Departments and General Services Administration file adverse reports with Senate Banking Committee on S. 1741, a bill for making alcohol butadiene from surplus grain.

. . . Natural Rubber Bureau estimates total new rubber consumption in 1960 at 3,500,000 long tons, of which 1,900,000 will be natural and 1,600,000 will be synthetic rubber. Synthetic production capacity in 1960 is estimated at 2,245,000 long tons.

. . . GSA's Floete says $833 million tied up in natural rubber stockpile and 71,056 long tons remain to be sold in upgrading program.

. . . Tire and tube industry condemns Labor Department minimum wage study as unnecessary and undesirable at time when tire-industry wage earnings are currently at the rate of approximately $2.60 an hour.

. . . The Justice Department has refused to appeal to the Supreme Court the Federal District Court ruling on tire quantity-limit discounts. An investigation by the Senate Small Business Committee of the Federal Trade Commission's handling of this matter is therefore planned.

. . . New plant and equipment capital expenditures for the chemical and rubber products industries established new records in 1956 and will be even higher in 1957.

. . . Sharp decline in quality in 1956 natural rubber imports starts campaign by Rubber Manufacturers Association to tighten inspection procedures. Only 58% of all grades imported into the U.S.A. conformed to RMA standards.

Washington Report

By ROBERT E. L. ADAMSON

Six Federal Agency Reports Scorn Proposed Senate Bill For Making Butadiene from Government Grain Surplus

The Eisenhower Administration made it clear in June that it wants no part of the already partially deflated program to produce substantial quantities of butadiene and other products from government surplus grains converted into alcohol. In a series of federal agency reports characterized by particularly strong language, five top-ranking officials of the Executive Branch added their protests to that registered in May by Comptroller General Joseph Campbell.

The total of six adverse reports was filed with the Senate Banking Committee on S. 1741, sponsored by Senators Carl Curtis, Nebraska Republican, and Paul Douglas, Illinois Democrat. S. 1741 would authorize an experimental program for making alcohol butadiene from the nation's vast grain stocks, chiefly corn. It would center on government-owned plants at Louisville (alcohol butadiene) and Omaha (alcohol), but would include other idle butadiene and alcohol plants owned by private interests. Millions of bushels of grain would be consumed over a period ending June 30, 1962, to produce huge quantities of butadiene and butadiene by-products for marketing in regular commercial channels.

No Louisville Plant Sale

The Administration's unanimous stand in opposition gave a little life to the dormant disposal of the Louisville plant, but the impending adjournment of Congress lay heavy against a sale this year. Thus Federal Facilities Corp., anxious to sell immediately, has just about run out of time, and it appears likely that nothing will be done to sell Louisville before expiration of the current lease held by Publicker Industries of Philadelphia. The lease runs out in April, 1958, and the General Services Administration will automatically take jurisdiction unless special sale legislation is approved by Congress in the interim.

Meanwhile the Welsh Commission on Increased Industrial Use of Agricultural Products—the group responsible for the idea embodied in S. 1741—filed its final report with Congress and failed to make a specific recommendation that the S. 1741 program be authorized. The Commission, however, discussed the pros and cons of the plan and left an augmenting decision to the lawmakers.

Agriculture Report

If Congress takes the advice it sought from the Administration, the decision will be a resounding "No dice." The most significant protest came from True D. Morse, Acting Secretary of Agriculture, whose Department would stand to gain the most if the plan were successfully

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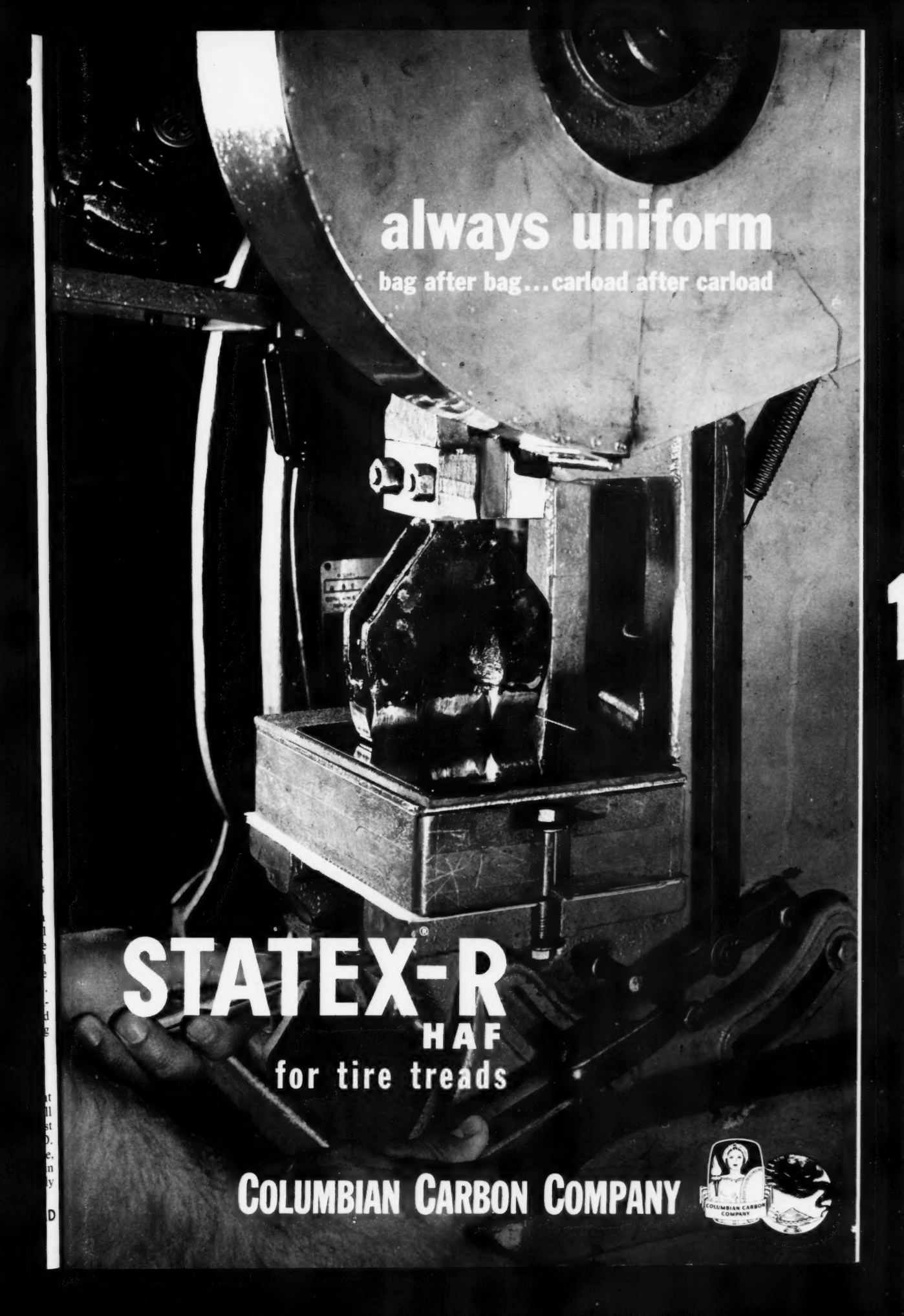
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carried off. He, however, took this position:

"While this Department . . . favors any measure which would result in increased economic utilization of grain, it opposes the enactment of S. 1741 . . . .

"It is our understanding that alcohol for production of butadiene, and thence synthetic rubber, must enter the process at a cost no greater than 25¢ per gallon if the production is to be competitive with synthetic rubber from other sources (petroleum or butane). Since the yield of alcohol from grain is about 2½ gallons per bushel, the gross return that could be visualized at 25¢ per gallon would be 62½¢ per bushel. The return for the corn to the Department would be between 40 and 50¢ per bushel, less transportation costs for the corn and alcohol."

(Without so stating, Mr. Morse indicated this was well below a feasible price for its grain in terms of what it has cost the government.)

He told the Senate Banking Committee, however, that there was a real need of research and development on uses for the by-products of conversion of grain alcohol to butadiene. In this process, he pointed out, only 60% is converted to butadiene; the rest is by-product for which economic uses should be found.

"But this type of research," he added, "is best conducted in a research laboratory or pilot plant rather than in a large plant."

In this connection the Department of Agriculture is the federal agency which expressed most interest in taking over the idle rubber research labs/pilot plant in Akron. In effect, the Department is bidding against Firestone Tire & Rubber Co., which has offered more than $700,000 for the facility. A decision on whether to sell is pending at the Bureau of the Budget.

Mr. Morse also reminded the Banking Committee that the Welsh Commission "was unable to agree upon a specific recommendation for activation of existing alcohol and butadiene plants." This was a reference to the fact that the Welsh group first voiced the advantages of an alcohol-butadiene program, then, in its formal reports to Congress, announced that a majority could not agree on the feasibility of a full-scale program.

Treasury Comments

Easily the most outspoken critic of the Douglas-Curtis bill was W. Randolph Burgess, who is Acting Secretary of the Treasury.

"It must be assumed," he warned, "that any production will be marketed competitively, and this obviously would necessitate a very heavy subsidy, it being universally conceded that alcohol butadiene cannot compete economically with its petroleum and butane-based counterparts."

Mr. Burgess said this was amply demonstrated during the two war periods when the government operated the alcohol-butadiene plants at Louisville and at Kobuta, Pa., now owned by Koppers, Inc., and no longer in production. He said "there is no reason to believe that further operation would show better results than those previously experienced.

On the questioning of financing the Douglas-Curtis program, Mr. Burgess noted that the bill calls for a revolving fund. Since heavy subsidies would inevitably be called for, in his view, a revolving fund would not work, "and large annual appropriations would become necessary to finance operations."

The Treasury officials then discussed the bill in terms of the government's long-standing policy to vacate the synthetic rubber industry in favor of private industry. The Disposal Act of 1953, he pointed out, "evidenced unequivocally the Congressional intent that the government remove itself from the business of synthetic rubber manufacture. . . .

"The situation today is that butadiene is in easy supply, and this condition is expected to continue. More butadiene capacity will be available in 1958 than will be needed for foreseeable requirements for rubber and all other purposes through 1959. The companies which bought 26 of the 27 government-owned synthetic rubber facilities have expanded capacity and found new industrial applications for their products. They have successfully filled the needs of industry and are creating an export market, all without any increase in the price of synthetic rubber.

"It seems neither fair nor logical for these purchasers of the government's facilities to have to face substantial competition subsidized by the government, since they were fully entitled to believe that their take-over of the government-owned plants in 1955-56 signalled the end of government operations in synthetic rubber.

"Among other unfortunate results, this would undoubtedly create a large surplus of butadiene which would not only have a depressing effect on the market, but would necessitate a cut-back in private production and stifle any incentive for further growth among the private producers."

Mr. Burgess said the Treasury Department was sympathetic toward research aimed at finding new uses for farm products, but added: "There is nothing experimental in the process of making butadiene from alcohol."

The Louisville facility, he contended, would not be satisfactory for either research or pilot-plant work on possible by-products of the alcohol-to-butadiene conversion. He said the program appeared to be not a research project, "but rather a large-scale commercial operation in heavily subsidized competition with private business."

Commerce Opposition

Secretary of Commerce Sinclair Weeks was also sharply critical of the government competition facet of the plan.

"The (nation's) economy," he said, "has long since rendered alcohol butadiene economically obsolete, and the same is true of the plants which contribute to its production. This economic fact was known before World War II, and the alcohol-butadiene capacity was installed as a wartime expedient only to assure an adequate volume of butadiene for the new war-born synthetic rubber industry."

Commenting on the principal purpose of S. 1741—to cut into the huge government grain surpluses—the Secretary pointed to the problems of disposing of these commodities abroad, under sale and barter programs, as an indication of what would happen to a disposal program in the domestic economy.

"Problems in disposal of these surpluses abroad," he declared, "have inevitably resulted from efforts to sell and to barter the grain. The proposal embodied in the bill would just as inevitably lead to domestic problems by rendering idle newly acquired private production facilities (much of it recently purchased from the Federal Government), by loss of tax revenue from the taxpaying production capacity thus idled, and by further increasing the tax burden and the price the consumer pays for rubber and rubber products.

"To us, this represents an attempt to correct the results of one inflationary program by adopting another inflationary measure."

Army and GSA Attitude

Secretary of the Army William M. Brucker and General Services Administrator Franklin G. Floete rounded out the Administration's position. Mr. Brucker pointed out that the military does not consider the program necessary to the defense posture. He emphasized, moreover, that the Army has already advised Congress to sell one of the plants on which the program would pivot—the Louisville facility.

Mr. Floete "dotted the i" with a thinly veiled hint to the Banking Committee to drop the whole idea and sell both the Louisville and Omaha plants while industry is in a position to pay a favorable price.

World Synthetic Rubber Capacity at 2,245,000 Tons By 1960; Natural Output 1,900,000 Tons, NRB Says

World production and consumption of natural rubber will remain constant at about 1,900,000 long tons between 1957 and 1960 inclusive, according to the Natural Rubber Bureau, Washington, D. C.

The Bureau also estimated that synthetic rubber consumption will reach 1,600,000 long tons throughout the world by 1960; while synthetic rubber production capacity will steadily climb to 2,245,000 long tons by that year, of which 1,860,000 long tons will be the production capacity of the United States synthetic rubber industry.

Canada, second to the United States as a synthetic rubber producer, will boost its capacity from the present 120,000 long tons to 150,000 long tons by 1960, while both West Germany and the United Kingdom will have a capacity of 50,000 long tons by that date. France, due to begin synthetic rubber production in 1959, is

expected to more than triple its production capacity to an estimated 65,000 long tons by 1960, making it the world's third leading producer.

The Bureau bases its estimate of natural rubber consumption on the assumption that all the natural rubber made available on the open market will be consumed, despite stocks varying from month to month. Although Malayan production will show increases from year to year owing to active and continuous replanting, Indonesia's production will decline because of lack of replanting. The Bureau adds that production in the other rubber producing areas will continue at about present levels.

The figures on synthetic rubber consumption were derived by subtracting natural rubber consumption from the total estimated world consumption of all new rubbers, since synthetic rubber must make up the difference.

All NRB's estimates for synthetic rubber exclude consideration of the Soviet Union and its satellites and Red China.

A summary of the Bureau's figures appears in the table below:

ESTIMATED WORLD NEW RUBBER POSITION TO 1960

(In 1,000 Long Tons)

Year	Natural Production and Consumption*	Synthetic Consumption†	Total Consumption‡	Synthetic Production Capacity§	Excess Synthetic Capacity over Consumption
1956	1,888	1,132	3,020	1,280	148
1957	1,900	1,200	3,100	1,570	370
1958	1,900	1,310	3,210	1,830	520
1959	1,900	1,440	3,340	2,000	560
1960	1,900	1,600	3,500	2,245	645

*World consumption or absorption.
†Excludes Iron Curtain countries and Red China.
‡Includes total consumption and/or absorption of natural, but excludes synthetic consumption in Iron Curtain countries and Red China.
§Excludes Iron Curtain countries and Red China.

GSA's Floete Reports on Natural Rubber Stockpile

F. G. Floete, GSA administrator, has advised the Congressional Joint Defense Committee that his agency had $833,000,000 tied up in the natural rubber stockpile, the largest single investment in a stockpile material not available in the United States.

Under authority of the Defense Production Act of 1950, he said, GSA had made gross transactions for acquisitions apart from rubber, for $1,200,000,000 for machine tools; $4,900,000,000 for minerals and metals; and $71,000,000 for interest to the Treasury, custodial and administrative expense.

Of the 38 stockpile items in the GSA rotation program certified to GSA by the Office of Defense Mobilization, only two involved a greater dollar investment than rubber: aluminum and machine tools.

Late in May, GSA issued a report on the status of its rotation program, disclosing a very substantial reduction in the stockpile tonnages of non-specification rubber of from 101,578 tons as of September 1, 1956, to 71,056 in April, 1957.

The report reflects a corresponding increase in tonnage of stockpile rubber specification grade. It also shows that of the 71,056 tons remaining to be sold in the upgrading program, as of April 30, 1957, the principal tonnages were in eight grades: #3 Amber, 35,946 long tons; #2 Browns, 9,105 long tons; #4 RSS, 7,934 long tons; #4 Ambers, 6,001 long tons; #5 RSS, 4,097 long tons; #4 Browns, 1,998 long tons; #2 Thin Pale Crepe, 1,344 long tons; and #2X Thin Browns, 1,085 long tons. Another year may be required to upgrade this remainder.

Tire and Tube Industry Condemns Minimum-Wage Study Begun by Labor Department under Walsh-Healey Act

The tire industry was up-in-arms in June over what it considers unwarranted Federal Government intervention in its relations with tire labor—one of the highest paid labor markets in the country.

Under the New Deal Walsh-Healey Act of the late 1930's, the Department of Labor has initiated a minimum-wage study of the tire and tube industry—an industry which already considers itself faced by one of labor's strongest unions, the United Rubber Workers of America, AFL-CIO. In cooperation with the Bureau of Labor Statistics, the Wage Hour Division of the Department is conducting a combined statistics-field study which will take federal investigators into the plants of more than 75 employers by the end of July.

The study is the first stage of a Department inquiry into a very complicated question: What is the prevailing wage in the industry? The answer, if endorsed by Secretary of Labor James P. Mitchell in a formal order, will set a practical wage floor for any firm doing business with Uncle Sam under contracts worth at least $10,000 each.

Walsh-Healey Outmoded

The tire and tube industry appears stunned that this could happen under a Republican Administration, in an unparalleled era of labor prosperity, and some 20 years after enactment of legislation designed to meet the exigencies of a great depression. In a word, the industry thinks this is carrying "modern Republicanism" too far. Spokesmen for the tire industry, recoiling from what they consider unfounded government intervention in labor-management problems, called the Walsh-Healey Act "obsolete and outmoded" and declared that the URWA was capable of securing decent wages on its own.

Walsh-Healey, still on the books though specifically designed to raise the standard of living when the government was trying to revive the economy, directs the Department of Labor to find the minimum prevailing wage in industries selling their products to the government and to require any contractor paying less to raise his wages to the minimum. Over the years the Department has applied this provision of Walsh-Healey to a number of industries, including automobiles and coal.

But the tire industry operates under a special incentive system which management spokesmen feel would collapse under the weight of a minimum wage. They point out, moreover, that very few tire and tube manufacturers produce tires and tubes alone. How do you apply a minimum wage, they ask, to a factory which produces not only tires, but also industrial rubber goods, sporting equipment, and thousands of rubber sundries?

Survey Procedure Unusual

The industry is also looking with a suspicious eye at the unusual procedure adopted for this particular investigation. Normally, the Department submits a proposed industry questionnaire for clearance by the Bureau of the Budget, which appraises the survey in the light of Administration policy. The questionnaire which did go to Budget was considerably less sweeping than the normal paper because, in this particular probe, the Bureau of Labor Statistics is sending field investigators directly into the plants, instead of relying on written answers to specific questions.

Spokesmen for both the BLS and the Wage Hour Division, however, made it clear this investigation is routine, required by the law and handled under methods adopted to do the most efficient job. The Wage Hour people emphasize that BLS had already scheduled a statistical survey of the tire and tube industry when Wage Hour decided the time was ripe for a Walsh-Healey probe (an earlier investigation slated to cover the tire industry was dropped when the Korean War broke out). Echoed by the BLS people, the Wage Hour spokesmen said the joint study was decided upon to save time, effort, and money and to increase efficiency.

In successive steps the Wage Hour Division convened a tire industry panel of both labor and management representatives, adopted an industry definition rather broad in scope, and instructed BLS what information the Division will need to work out a prevailing wage. Eventually the Division will schedule a public hearing at which "labor and management will be free to supplement the BLS data." A Wage Hour official pointed out that Secretary Mitchell may be called upon to approve more than one figure—depending on what the studies show on different geographical areas and other factors. The basic criterion

which Wage Hour will use in defining "prevailing" wage, however, was a government secret.

"Our job," a Division official declared, "is to find out what the prevailing wage is in the industry. If the Secretary agrees (with our appraisal) he will issue an order and anybody interested in government contracts of $10,000 or more must pay the minimum wage."

He said the tire industry panel had been "fully cooperative" in helping to lay the ground-work for the investigation and "helped us a great deal on both the industry definition and the data to be collected." Only "one or two minor points" of disagreement arose during the panel meetings, he said. Management spokesmen indicated they merely went along with the inevitable, though they do not like it.

RMA Objections

Ross R. Ormsby, president of The Rubber Manufacturers Association, Inc., said "there isn't anybody in our industry who wants the Walsh-Healey probe. As a matter of fact, they don't want the BLS survey (which had been scheduled separately before the arrangement with Wage Hour was worked out). It's a waste of time and a waste of money."

On the other hand, he said, the labor people "think it is a fine idea. They think it can't hurt them and, by government edict, they may get something out of it.

"We think they're pretty capable of getting that themselves."

Ormsby said tire-industry wage earnings were at least as high or higher than those in the steel, automobile, and electrical industries or about $2.60 an hour. Under the industry's incentive system, he readily conceded, the "guaranteed" wage is lower. But, he added, "the system has been used in the industry for many years, has been accepted by the Union, and they know all about it."

He contended further that most government business is done by the Big Five of the industry—Goodrich, Goodyear, U. S. Rubber, Firestone, and General. These companies, he said, "pay as high as anybody in the industry." He as much as asked:

Why spend taxpayer funds to guarantee high wages from government contractors who already pay high wages?

On one point, however, the industry and government are in agreement—that the tire business is very complicated. For this reason, the Labor Department said, its criteria are too indefinite to be disclosed and discussed with any finality. Department spokesmen explained, however, they will take all of the factors unique to the industry into account in coming up with the "prevailing" wage or wages.

Justice Department Refuses to Appeal Federal Court Tire Discount Ruling; Senate Plans Investigation

In the name of small business, George J. Burger, vice president of the National Federation of Independent Business, culminated a one-man crusade against the Department of Justice and Federal Trade Commission with the announcement that he had succeeded in persuading a Senate small business subcommittee to investigate the government's handling of the "quantity discount" case on the sale of tires and tubes.

Sen. John Sparkman, Alabama Democrat and chairman of the Senate's Small Business Committee, announced he had ordered Sen. Hubert Humphrey, Democrat from Minnesota, to schedule an investigation of anti-trust enforcement in the tire industry, centering chiefly on the government defeat in March when the Federal Court of Appeals here threw out quantity-discount suits against 20 manufacturers and marketers of tires.[1] The Court ruled that the FTC rule limiting discounts to tire purchases under 20,000 pounds was couched in terms contrary to the Robinson-Patman Act under which the rule was promulgated.

No Appeal by Justice Department

Independent business spokesman Burger demanded that the Department of Justice appeal the Appeals Court ruling to the United States Supreme Court. When Justice's anti-trust chief, Victor R. Hansen, informed him the ruling would not be appealed, Mr. Burger repaired to Capitol Hill for Congressional intervention. He presented Senator Sparkman with the history of 21 years of FTC effort (or alleged lack thereof) to "eliminate the use of unfair marketing practices in the rubber tire industry." In so doing, he contended that small businessmen in the tire industry needed—but were not getting from the FTC, despite the existence of the Clayton and Robinson-Patman Acts—protection against purported unfair marketing practices at both the production and distribution levels of the industry.

The Appeals Court decision which Uncle Sam has declined to appeal pointed out that the pertinent provision of the Robinson-Patman Act requires the FTC to determine whether "available purchasers in greater quantities (than 20,000 pounds) are so few as to render differentials on account thereof unjustly discriminatory or promotive of monopoly." The Court said, however, FTCs determination spoke only of the number of tire and tube purchasers having annual dollar volumes greater than $600,000. Thus, its finding, the Court held, did not follow the clear Robinson-Patman mandate to determine how many purchasers buy in 20,000-pound lots.

Senate to Investigate

Senator Sparkman, in announcing his decision to order an investigation by Senator Humphrey's subcommittee, called the FTC defeat in this case the "most notable"example of its failure to get an anti-trust conviction in the tire industry.

" . . . the record made by the FTC in its actions against anti-trust wrongdoing in the rubber tire industry has been, for the most part, one of futility," the Senator declared. "Most notable in this regard is the complete failure of the Commission in its proceeding to establish a 'quantity discount' rule for the sale of automobile tires and tubes.

"After ten years of costly and inclusive litigation, that case has now been abandoned by the anti-trust agencies. Yet, the monopolistic discount practices, which the action was supposed to eliminate, continue unabated, to the serious injury of the nation's independent tire dealers.

"Under such circumstances, it would seem highly appropriate for the Committee to schedule a public inquiry into the causes underlying the Commission's undistinguished record of anti-trust enforcement in the rubber tire industry. In such an investigation, particular emphasis would be placed upon finding out why the Commission performed so poorly in prosecuting the important 'quality limits' case.

"I feel that Congress should know whether the failure in that case stemmed from a statutory deficiency or, rather, from a lack of enforcement determination on the part of the Commission. . . . I have assigned this investigation to the Subcommittee on Retailing, Distribution and Fair Trade Practices under the chairmanship of Senator Humphrey. Senator Humphrey . . . intends to proceed with this investigation just as soon as the necessary staff work has been completed."

Companies Involved

Freed from federal suits by the Appeals Court decision were the following firms: B. F. Goodrich, General Tire & Rubber, Goodyear, Firestone, Allied Tire & Battery, U. S. Rubber, Inland Rubber, Pacific Tire & Rubber, Denman Rubber, Mansfield Tire & Rubber, Carlisle Corp., Durkee-Atwood Co., Seiberling Rubber, Dunlop, Missouri Farmers Assn., Western Auto, Montgomery Ward, Dayton Rubber, Lee Rubber & Tire, and American Oil Co.

FTC Hearings on TBA Items Resumed With Broad Scope

A trial examiner for the Federal Trade Commission resumed hearings in three TBA cases (tires, batteries, and accessories) in June after a layoff of several months.[2] Examiner Edgar Kolb scheduled a round of hearings in four cities on three FTC complaints against six major rubber and oil companies—B. F. Goodrich and Texas Co.; Goodyear Tire & Rubber and Atlantic Refining Co.; and Firestone Tire & Rubber and Shell Oil Co.

The firms are accused of restraint of trade because of "overriding commission" agreements under which the oil companies are paid commissions on sales of rubber-company TBA items through the oil companies' branded gasoline stations. The FTC has charged that the commissions are not earned by the oil companies, and that the agreements exclude other TBA manufacturers from selling their products to the gasoline dealers involved. All six of the firms, however, have denied that anything they are doing under the agree-

[1] RUBBER WORLD, Apr., 1957, p. 89.
[2] *Ibid.*, Apr., 1957, p. 90.

ments is illegal, but that station operators are free to and do market TBA products of their own choice, and that promotional functions performed by the oil companies earn them the right to collect sales commissions.

The Goodyear-Atlantic hearing resumed in Baltimore on June 12, moved to Philadelphia on June 13-14 and again on June 24, and went from there to Wilmington, Del., on July 1. The Firestone-Shell case was scheduled to be picked up here during the week of July 8, followed by a resumption of the Goodrich-Texas hearings during the week of July 15.

The proceedings, enlarged considerably by an FTC ruling that every commission agreement involving any of the companies was relevant, were delayed for months when Examiner Kolb was called to the Pacific Coast for extended hearings in another case. It has been estimated that the FTC ruling on relevant agreements will bring more than a score of oil companies into the proceedings who were not cited in the original complaints.

Tire Retreading Institute Announces Significant Advance; Hypalon Sidewall Coatings Being Tested

The Tire Retreading Institute, E. I. du Pont de Nemours & Co., Inc., and Chemical Coatings & Engineering Co., Edgemont, Pa., joined forces on June 18 to acquaint the public with a new compound of Du Pont's elastomer—Hypalon. Described by Du Pont's Alfred J. Northam as a "hybrid synthetic rubber-plastic" because of its polyethylene base, Hypalon was developed a few years ago, but was too expensive to compete with other synthetic rubbers, including the company's neoprene.

The Pennsylvania coating firm, however, has come up with a compound of Hypalon which holds out great promise for the tire and retreading industries, because, according to its developers, it is completely unharmed by ozone. It also shows good adhesion to synthetic and natural rubber, has a high degree of flexibility and color stability, and is resistant to heat, scuffing, and abrasion. Mr. Northam said Hypalon would offer effective competition to neoprene except for its prohibitive price—85-90¢ per pound. [A price reduction to 70¢ a pound effective July 26, was announced by Du Pont on June 21—EDITOR.]

Coating Tests

To test the Hypalon compound's effectiveness against the oxidation or ozone-cracking of tire sidewalls, the Tire Retreading Institute (TRI) has scheduled it for "road work" in the Los Angeles area, where smog and chemicals in the area ought to offer pretty convincing evidence that the stuff works, if the tests are successful. Of course, successful retardation of ozone-cracking in tire sidewalls figures to help the retreading industry increase its business. W. W. Marsh, TRI's executive secretary, put it this way in his sales talk to the press:

"If these tests prove successful, the commercial use of this compound on new and used whitewall and blackwall tires will have a significant effect upon the general motoring public and on the retreading industry.

"Seventy per cent of a motorist's investment in a new tire is in the tire casing and only 30% in the tread rubber. Thousands of economy-minded motorists, when the tread rubber begins to fade, now are recapturing their original investment in their tire casings by having them retreaded if they are in good, sound condition.

"An elastomer compound that is ozone-proof and thus will preserve and greatly extend the life of tire casings should make available an abundant supply of sound, retreadable tires, enabling the retreading industry to increase greatly its production of safe, dependable and low-cost retreads, which already save motorists about one-half the cost of new replacement tires."

In carrying out the tests four TRI members in the Los Angeles area will coat one-half of the sidewall area of each tire. After the tires have been in use 45 days, they will be inspected, and detailed reports on both treated and untreated portions will be forwarded to TRI headquarters here for study and evaluation. While the road tests are in progress, an accelerated ozone test will be made of the special compound in the laboratory of a major rubber company. The compound, especially prepared for sidewall application, will be exposed to high concentrations of ozone to determine its maximum resistance to cracking under the most severe conditions.

Economics and Future Prospects

The economics of the Hypalon compound, according to Du Pont and Chemical Coatings, are essentially these: (1) It will sell to car owners for about $2 per can at retail, enough to cover a five-tire set; and (2) it will cost retreaders about 20¢ each for tires they apply it to.

Hypalon itself, over three times the cost of some synthetics, is in low production at present, but the company is adding new facilities at Beaumont, Tex., to boost annual output to 7,500 tons later this year. The high cost of Hypalon is due chiefly to the fact that its feed material, polyethylene, sells for 35-40¢ per pound. Du Pont feels a strong consumer demand would permit more direct production from natural gas and thus cut Hypalon's cost substantially.

Chemical Coatings said it believes this demand will develop because cracking is not only a major problem for tires, but for hundreds of other rubber products, as well.

"To us," a company spokeman said, "Hypalon is an important challenge because it is a unique material. Although a chemical rubber, it is also a bridge to the plastics and the basis for almost limitless combinations with resins and rubbers. This will have particularly great impact in the coatings industry, our field of keenest interest. . . . Already the supply of coatings for elastomers is one of our important markets.

"In expectation of a rapidly developing industrial and consumer market, we have geared our production facilities to a greatly increased volume of Hypalon coatings."

Armstrong Rubber Co. has been using Hypalon for two years, blending it with natural and neoprene to add to the life of white sidewalls. Hypalon is also in use to line chemical tanks, jacket wire, and as a blend with other elastomers to prevent premature failure. Basically polyethylene, it is reacted with chlorine and sulfur dioxide to form a vulcanizable rubber.

National News

New Plant and Equipment Expenditures Break Record In 1956 for Chemical and Rubber Products Industries

The Commerce Department's publication, "Chemical and Rubber Industry Report," for May, 1957, makes the point that expenditures for new plant and equipment by both the chemical and the rubber products industries established new records in 1956, and that both industries anticipate even greater expenditures in 1957.

Chemical and Allied Products

Breaking all previous records, the chemical industry outlay for new plant and equipment in 1956 amounted to $1,455 million, a sharp rise of 43% over 1955 figures and 2% over 1953 outlay, the former record year, it was said.

Chemical industry capital expenditures in the second half of 1956, rising 25% above the first half to $808 million, the highest point ever reached for a calendar half-year period, paralleled the 24% rise in the same period for all manufacturing industries.

Despite the tremendous rise in capital expenditures during 1956, the chemical

industry anticipates even greater expenditures in 1957. Estimates for the first half amount to $895 million, an increase of 11% over figures for the second half of 1956; while for the entire year contemplated expenditures are $1,799 million, up 24% from 1956. In comparison, all manufacturing industries anticipate a decline of 2% during the first half of 1957, but an accelerated pace for the remainder of the year is expected to result in a 10% increase for the year as a whole over 1956.

Rubber Products

Surpassing anticipations by $2 million, expenditures for new plant and equipment in the rubber products industry reached the record total of $201 million in 1956, exceeding the 1955 figure of $150 million by 34%, and the former record of $161 million, set in 1953, by 25%. Outlays in the second half of 1956, at $111 million, were 23% greater than in the first half, and also were the highest ever recorded in a calendar half-year period.

It is anticipated that capital outlays for 1957 in the rubber products industry will total $208 million, equally divided between the two halves of the year.

The rubber products industry, traditionally very competitive, has usually managed to have output capacity ready considerably in advance of expected normal increase in demand, permitting sudden upturns to be handled in stride. The recent course of capital outlays indicates that the industry continues to be prepared, the Commerce Department publication concluded.

The accompanying table presents figures on capital expenditures for all manufacturing, chemical, and allied products, and the rubber products industries for the period 1947 through 1956, with estimates for the first two quarters of 1957.

U. S. EXPENDITURES* ON NEW PLANT AND EQUIPMENT, ALL MANUFACTURING, CHEMICAL, AND RUBBER PRODUCTS INDUSTRIES, 1947-1957

(Millions of Dollars)

Year	All Manufacturing	Chemical and Allied Products	Rubber Products
1947	8,703	1,060	143
1948	9,134	941	102
1949	7,149	670	81
1950	7,491	771	102
1951	10,852	1,247	150
1952	11,632	1,386	154
1953	11,908	1,452	161
1954	11,038	1,130	131
1955	11,439	1,016	150
1st quart.	2,249	231	30
2nd quart.	2,794	230	36
3rd quart.	2,898	239	39
4th quart.	3,498	316	45
1956	14,954	1,455	201
1st quart.	2,958	283	40
2nd quart.	2,734	364	50
3rd quart.	3,834	370	50
4th quart.	4,428	438	61
1957†	16,414	1,799	208
1st quart.	3,908	433	51
2nd quart.	4,177	462	53

*Data exclude expenditures of agricultural business and outlays charged to current account.

†Represent estimates based on anticipated capital expenditures as reported by business from late January to early March, 1957.

SOURCE: Based on business reports to the U. S. Department of Commerce and the Securities & Exchange Commission.

Sharp Quality Decline of Natural Rubber Imports Sparks RMA Campaign to Get Tightened Inspection Procedures

CONFORMANCE OF U.S.A. DRY NATURAL RUBBER IMPORTS TO RMA STANDARDS—1953-1956*

RMA Grade	Est. % of Total Use	% of Total Imports: Conformed to Standard 1953	1954	1955	1956	Were ½ or More Grades Off 1953	1954	1955	1956
All Grades	100.0	69.1	71.7	62.6	58.2	12.5	13.6	17.1	19.9
#1 RSS	17.2	82.4	81.3	73.1	72.4	5.0	8.1	10.5	12.1
#3 RSS	8.7	61.6	77.4	62.9	53.3	13.2	12.1	19.0	22.4
#4 RSS	16.8	67.0	78.8	58.9	56.2	12.9	6.2	19.3	16.8
#5 RSS	5.5	63.1	71.8	57.7	64.4	9.5	5.9	9.9	6.9
#3 Thin Brown Crepe	5.3	40.0	38.0	40.6	24.4	28.8	29.6	27.7	44.7
#4 Thin Brown Crepe	3.4	65.9	65.3	59.4	44.6	4.5	5.2	10.7	17.7
#3 Thick Blanket Crepe (Amber)	17.2	25.1	28.0	24.5	18.8	44.3	49.1	45.6	51.2
#4 Thick Blanket Crepe (Amber)	4.6	70.5	80.1	67.4	70.6	9.3	5.5	10.4	7.6
Flat Bark	5.4	88.9	81.1	59.9	72.4	1.9	4.0	21.5	6.4
	84.1								

*For all grades and certain selected grades and accounting for approximately 84% of industry requirements.

A sharp decline in the quality of natural rubber imports has led the Crude Rubber Committee of The Rubber Manufacturers' Association, Inc., to organize a broad campaign to tighten inspection procedures and claim practices among consumers in all parts of the world.

Quality Analysis

This decision was said to have been based on disclosure in a just completed analysis of dry natural rubber imports for 1956 that only 58.2% of the tenders were up to RMA standards. The degree of non-conformance was the highest in the six years covered by the annual quality analysis, which is based on data supplied by the Rubber Trade Association of New York and the RMA, exclusive of rubber packed in Singapore by subsidiaries of United States manufacturers.

RMA Campaign

Meeting in Akron on May 14, the committee concluded that since packers in the Far East are sufficiently familiar with the standard grades to pack them properly, those responsible for offering off-quality rubber must be fully aware that they are doing so.

The committee listed the following conditions as making profitable substandard packing: the influence of foreign exchange difficulties on the market, discount prices, the practice of off-loading at Singapore, rubber declared for distant ports, and inadequate inspection in so-called soft ports in consuming countries (as opposed to hard inspection ports like those in the U. S.)

U. S. companies represented on the committee own, partially own, or have technical assistance contracts with 71 of the 114 tire manufacturing companies elsewhere in the free world. It was therefore agreed that the quality problem should be attacked first by tightening inspection at those plants.

Domestic companies were urged to supply all their foreign affiliates with type samples. The RMA said it would join companies in supplying educational and training material which is pointed at improving inspections and claims procedures.

The RMA committee also said it would make every effort to promote adherence by all endorsing organizations to the standards set forth in the new "Type Descriptions and Packing Specifications for Grades of Rubber Used in International Trade," adopted in February of this year.

MRERB Supported

The committee will continue its support of the Malayan Rubber Export Registration Board and for the effective operation of that organization. Lastly, as a counter measure against prevailing market conditions, domestic manufacturers will be urged to tighten their inspection programs to assure that they are fully compensated for deliveries of substandard rubber.

Concerning the latter, the Association was enjoined to alert all U. S. manufacturers to the unsatisfactory condition of imports, as reflected in the new quality analysis, and to emphasize to them the urgent need of adequate inspection at port or factory if they are to realize their just claims and properly preserve their competitive position in the industry.

U.K. Concern

The declining quality of exports of natural rubber from the Far East was also worrying United Kingdom rubber manufacturers. The point was brought up in London on May 27 at a conference of representatives of U. K. consumers, the Rubber Trade Association of London, and a Malayan group which was led by the Malayan Rubber Export Registration Board.

More aggressive enforcement of the Malayan Rubber Packing and Shipping Ordinance of 1950 was urged. Improved methods of inspection and handling of rubber in the United Kingdom will be studied.

Breakdown by RMA Grades of Natural Rubber Imports

The Rubber Trade Association of New York and The Rubber Manufacturers Association Inc., have jointly issued a breakdown by RMA grades of imports of natural rubber into the United States, excluding rubber packed in Singapore by subsidiaries of U. S. manufacturers. The figures cover 74.5% of total dry natural imported during 1956.

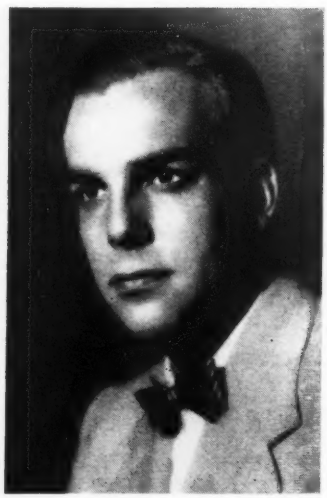
Ribbed Smoked Sheets amounted to 232,250 long tons, or 61.4%, of the total 378,295 long tons imported during 1956. The major RSS grade imported was #3, with 85,457 long tons. Following were #1X-1, with 58,606 long tons; #4, 44,226 long tons; #2, 25,596 long tons; and #5, 18,365 long tons.

A summary of the breakdown is as follows:

RMA Grades	Long Tons	% of Total
Ribbed Smoked Sheets	232,250	61.4
Pale Crepe	12,770	3.4
Estate Brown Crepe	14,862	3.9
Thin Brown Crepe	30,886	8.2
Amber Blankets	56,192	14.9
Smoked Blankets	11,477	3.0
Flat Bark	19,858	5.2
Total	378,295	100.0

Other Industry News

Philip Salisbury



John W. Hartman

Bill Brothers Publications Elect New Officers

At a directors' meeting of Bill Brothers Publications, June 18, Philip Salisbury was elected chairman of the board, and John W. Hartman, president, to fill the vacancies created by the passing of Raymond Bill. Bill Brothers Publishing Corp. publishes eleven business magazines including RUBBER WORLD, *Plastics Technology*, *Sales Management*, and *Tide*.

Mr. Salisbury joined Ray Bill in 1928 when *Sales Management* was purchased from Dartnell Corp., at which time Salisbury was vice president and eastern sales manager of Dartnell. Previously he had been general sales manager of Ingersoll Watch Co. During his career to date he has been active in association work in the publishing and marketing fields, having been president of the American Marketing Assn., first president of the Dotted Line Club, active on committees of the Sales Executives Club of New York, National Sales Executives, Inc., Associated Business Publications, and National Business Publications.

Mr. Salisbury has served on the Bill Brothers directorate for many years and will also continue as editor and publisher of *Sales Management* and chairman of the executive committee of *Tide*.

John Hartman joined the Bill organization in 1948 after having been a founder-partner and executive vice president of Bacon, Hartman & Vollbrecht, Inc., advertising agency in Jacksonville and St. Augustine, Fla. Previously he had been with United Press and Commercial Credit Corp.

During the closing stages of World War II he had been founder and editor of the United States Navy's largest-circulation newspaper.

Before becoming vice president of Bill Brothers he was sales director of *Sales Management*. He has also served on the Bill Brothers board of directors. Mr. Hartman has been active in numerous business and publishing associations, such as National Business Publications, Associated Business Publications, Magazine Publishers Assn., National Industrial Advertisers Assn., and National Sales Executives, Inc.

Du Pont Warns High Taxes Hurt Productive Growth

The share of the nation's output now going into taxes can be cut almost in half by 1975 if the tax structure is revised to encourage individual accomplishment and sustain the creative forces of production.

This belief was expounded by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., in a 32-page booklet, "The Story of Taxes," released in early June. The publication is the latest in a series called "This is Du Pont," which is distributed nationally.

Even if taxes should stay at the present high level of more than $100 billion a year, the burden will become far less if national output is expanded to $750 billion, 82% above 1956 output, as predicted, the company said. Taxes then would preempt not 25% of the nation's production, as they do now, but only about 14% of it.

The company concedes the cost of government services essential to the nation must remain high, but declares it must be kept well behind the rate of advance of production if the country's standard of living is to continue growing.

The booklet points out that present tax laws threaten to slow or cripple the nation's potential for growth and thus undermine the potential for tax cuts. It emphasizes also that the full potential for growth can be attained only if people discipline strictly their demands for government services, and if individuals are provided the incentives to develop their ideas and to invest their savings in high-risk ventures, that is, small and venturesome firms, vital elements in the nation's overall economic growth.

What is needed, Du Pont suggests, is a tax structure that will encourage individual incentives and make the opportunity for gain more nearly commensurate with the risks.

New Natco Division

Formation of a plastics machinery division has been announced by National Automatic Tool Co., Inc., Richmond, Ind., manufacturer of multiple-spindle drilling and tapping machines and automation transfer machines. This new division, which will produce plastics injection molding machines, marks a major diversification move for the 56-year-old firm.

Russell W. Powell has been named sales manager of the division, and Richard M. Norman has been named chief engineer.

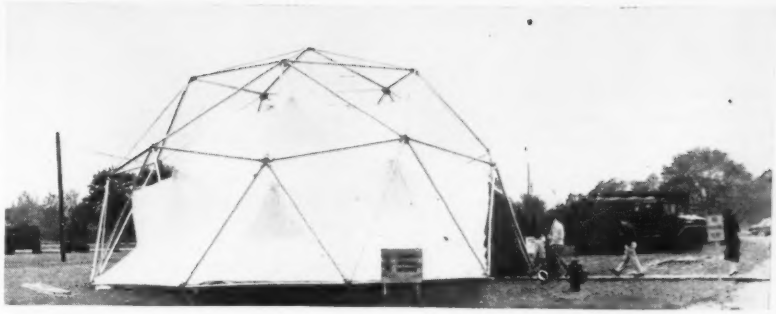
Thiokol Rubber Used in Race-Car Fuel-Tank Coating

Fourteen of the competing cars in the recent Indianapolis Memorial Day classic had rubber-coated fuel tanks, according to Thiokol Chemical Corp., Trenton, N. J., manufacturer of the liquid rubber component of the coating.

The coating, applied like paint over the outside of the gas tanks, is said to have already proved itself in crash conditions. In one crack-up last year at Indianapolis, the metal of the tank split but the rubber coating held, preventing dangerous fuel spillage.

The coating, called Rubber Coat, is manufactured by Products Research Co., Los Angeles, Calif. The Thiokol liquid rubber, which cures to a solid at normal temperatures, has heretofore been used in sealants for the interiors of airplane wing tanks, in building sealants, and in marine and industrial coatings and paints.

The 14 cars with rubber-coated fuel tanks entered in this year's race at Indianapolis were all built by Frank Kurtis Co., Glendale, Calif.



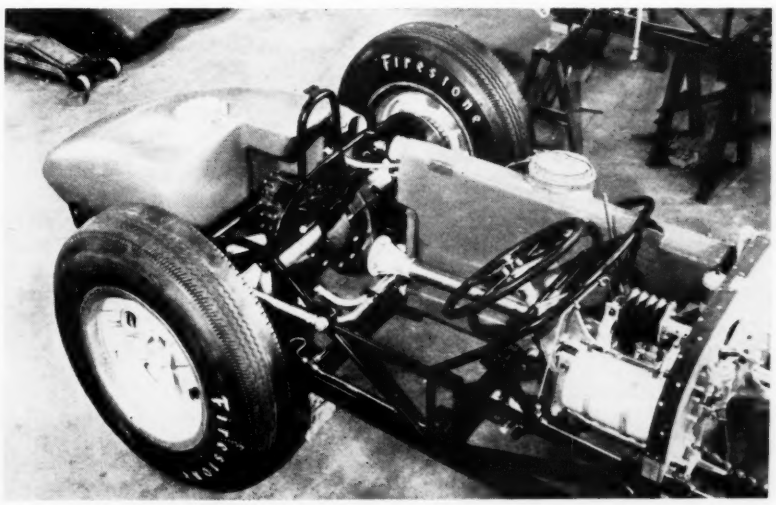
Army's new geodesic catenary tent just before final tightening adjustment

Army Shows PVC-Coated Nylon Geodesic Storage Tent

A polyvinyl chloride-coated nylon geodesic catenary tent designed as a semi-permanent storage place for military supplies has been shown to the public by the United States Army at the Detroit Arsenal.

The tent consists of a geodesic structure frame made of aluminum alloy tubing and a fabric dome. The dome is made of Welkote, a filament nylon-base fabric manufactured by Wellington Sears Co., New York, N. Y., and coated with a virgin polyvinyl chloride compound by Domestic Film Products Corp., Millersburg, O.

The coating was designed for outdoor weather resistance, translucency, and suitability for electric welding. The finished 14-ounce material has a tensile strength of 250 pounds per inch of width. With a total frame weight of 1,350 pounds and fabricweight of 325 pounds, the geodesic tent has a weight of 1.24 pounds per square foot of floor space. It requires 22 man-hours to erect.



Rubber-coated fuel tanks are shown in place on race car bodies built by Frank Kurtis Co.

Sun Oil's Hoel Retires

Archie B. Hoel, special technical representative for Sun Oil Co., Philadelphia, Pa., has retired after 24 years of service with the company.

An authority on rubber processing oils, Dr. Hoel joined the company in 1933, working on the development and uses of petroleum derivatives in the processing of rubber, leather, textiles, plastics, and printing inks. Before joining Sun he had been a research chemist for 11 years with Atlantic Refining Co.

He received his B.A. degree in chemistry from the University of Montana and a doctorate degree from Cornell University in 1921. During World War I he served as a sergeant in the ordnance department.

Dr. Hoel is a member of the American Chemical Society, American Leather Chemists Association, Division of Rubber Chemistry of the ACS, Alpha Chi Sigma, Sigma Xi, and Sigma Chi.

Tyer Acquires Plastimold

Tyer Rubber Co., Andover, Mass., has acquired control of Plastimold, Inc., Middleport, N. Y., manufacturer of plastic footwear. The acquisition of plastimold, Inc., was accomplished by an exchange of common stock.

The present operating management of Plastimold, consisting of Sydney Porter, vice president in charge of manufacturing and development, and Edward H. Goddard, superintendent and plant engineer, will continue, according to Wallace E. Brimer, president of Tyer. Philip L. MacLean, an 18-year associate of Tyer, has been named resident manager of the acquired firm.

Named general officers of Plastimold are Wallace E. Brimer, president and treasurer; Frank J. Emmett, Tyer's vice president, sales, as first vice president, marketing; Alan L. Skaith and Eric Dent, vice presidents; and Gaynor K. Rutherford, secretary.

Plastimold plant at Middleport, N. Y.

Compacter, Versatile General Tire Air Spring Announced

The General Tire & Rubber Co., Akron, O., has announced its development of a compact, versatile air spring for which a performance and adaptability superior to those of any spring yet introduced are claimed.

Applicable to automobiles, truck and buses, the new air spring is said to bring about a big reduction in space requirements and to permit the lowest spring rate yet attainable.

According to the company, the design involves a new configuration of rubber and metal parts in a more compact spring which requires much smaller air volume. It does away with the need of an auxiliary air compression chamber, utilizing instead only the spring volume.

The air spring is a band-diaphragm type unit, which is an air cell retained by a metal band to form a rolling diaphragm. As in all air springs, the load is supported by air pressure acting against an area (referred to as "the effective area"), permitting a constant car height regardless of the number of passengers.

In the General Tire spring, the spring rate (the load change per unit of deflection) from full jounce to full rebound can be tailored to fit the curve designed by the suspension engineer. A soft ride is developed at normal suspension position by designing that portion of the curve to have a low spring rate.

The rate is increased as the suspension goes into jounce or rebound to prevent strike-through and excessive roll. The rate increases very rapidly toward the end of the jounce stroke so that the size of the jounce bumper can be reduced to a minimum.

The characteristics of the General Tire spring can be fashioned to suit the suspension engineer's requirements because of its design flexibility, the company says. The effective area change, in combination with the adiabatic compression of air, determines the spring characteristic. On the General Tire air spring, the effective area can be controlled so that it gives the desired vibration frequency (spring rate).

Summing up, the company cites four essential differences between its new air spring configuration and others: the General air spring has a piston which can be firmly attached to the suspension arm, eliminating additional heavily loaded joints; less space required for the spring; greater design flexibility; and a design which does not stress the fabric and rubber as much as on other springs, thus prolonging the life of the spring.

Artist's conception of General's air spring functioning in a passenger car

New MIL Spec, Standard

A new Military Specificaion and a new Military Standard have been issued by the Department of the Navy, Bureau of Ships, Washington, D. C.

Military Specification MIL-M-19863 (Ships) of April 26, 1957, covers a Mount, Resilient, Type 5B5000. This is for a synthetic rubber element, resilient mount, with a load capacity from 3,500 to 5,000 pounds. The resonant frequencies of this mount are five, plus or minus one, cycles per second in both the axial and transverse directions within the load range of 3,500 to 5,000 pounds.

This specification contains a qualification clause. Accordingly, awards will be made only for such mounts as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable qualified products list. Manufacturers are urged to have the mounts they propose to offer to the Federal Government tested for qualification so that they may be eligible for awards of mounts covered by this specification.

Another of the Bureau of Ships visual inspection guides on various rubber products has recently been issued as a military standard. This is Military standard MIL-STD-297. Visual Inspection Guide for Hard Rubber (Ebonite) Items.

SPI Elects Officers

C. Russell Mahaney, vice president and a director of St. Regis Paper Co. and general manager of its Panelyte Division, New York, N. Y., has been elected president of The Society of the Plastics Industry, Inc., and will serve for the next two years.

One of the pioneers in the plastics industry, Mr. Mahaney has been active in various SPI functions since it was founded 20 years ago. He succeeds Norman Anderson, president of General Molded Products, Inc., Des Plaines, Ill., who was elected chairman of the SPI's board of directors.

R. B. Gutsch, president of aaRBee Plastic Co., Los Angeles, Calif., was elected vice president and director. William C. Bird, president of Prolon Division, Prophy-lac-tic Brush Co., Florence, Mass., has been reelected secretary-treasurer and director of the society.

Newly elected members of the SPI board of directors are: C. W. Bentley, Colt's Plastics Co., Inc., Hartford, Conn.; Elmer N. Huling, Wilcox Plastics, Inc., Montebello, Calif.; E. M. Osgood, C. F. Church Division, American-Standard, Holyoke, Mass.; Robert T. Todd, Irvington Varnish & Insulator Division, Minnesota Mining & Mfg. of Canada, Ltd., London, Ont.

Also Larry Gering, Gering Products, Inc., Kenilworth, N. J.; Robert K. Mueller, Monsanto Chemical Co., plastics division, Springfield, Mass.; Carl H. Pottenger, Koppers Co., Inc., chemical division, Pittsburgh, Pa.; R. C. Weigel, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Firestone Testing Matador

The Firestone Tire & Rubber Co., Akron, O., has been awarded a contract by Martin Co. to develop and test vital components of the new Matador TM-61 B guided missile. Work will be conducted by the company's defense research division and its Monterey, Calif., engineering laboratory.

Firestone is currently working on guided missiles for three branches of the Armed Forces. Its Los Angeles, Calif., plant has been manufacturing the supersonic Corporal missile for the U. S. Army since 1951. A new submarine launching system for the Regulus guided missile is being developed by the rubber company for the U. S. Navy.

Students Hear Humphreys

No human undertaking can ever succeed unless it is in response to a human need and grows from an understanding of human needs, H. E. Humphreys, Jr., president of United States Rubber Co., New York, N. Y., told the graduating class of Lycoming College, Williamsport, Pa., in a commencement address, June 2.

"Tomorrow's progress, which will be faster than today's, will be made by people working together," he declared. "You will be happier if you contribute to that progress and share your labors and success with others."

Mr. Humphreys received the honorary degree of Doctor of Humanities for his work as a leader in industry.

Goodyear Revises Flooring

Production and color revisions in its complete lines of vinyl and rubber flooring have been announced by the flooring department of The Goodyear Tire & Rubber Co., Akron, O.

In vinyl flooring, only two types will be produced in both the marbleized and the Triple-Tone style lines: custom and deluxe. In marbleized flooring, the line has been expanded to 29 and includes the introduction of 11 new colors. All colors will be available in 0.080- and 0.125-gage.

In the Triple-Tone style, a homogenous flooring will be produced. Called Triple-Tone deluxe, it will be available in 0.080-gage and have the same 14-color series presently available in the custom type. A new cork tone style is planned for both custom and deluxe Triple-Tone.

In rubber flooring, the company will continue to manufacture current gages for residential and commercial application with the addition of three new colors to expand the decorator selection to 26.

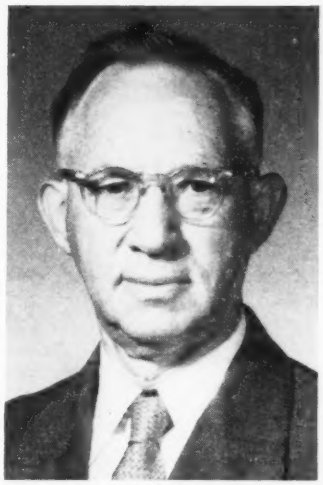
NBS' Madorsky Honored for Polymer Structure Work

Samuel L. Madorsky, since 1940 a physical chemist at the National Bureau of Standards, Washington, D. C., has been awarded the Department of Commerce Silver Medal for Meritorious Service in recognition of his "researches which have contributed greatly toward an understanding of the relationship between molecular structure and thermal stability of polymers."

A member of the NBS polymer structure section, Dr. Madorsky has been conducting work on the thermal degradation of polymers as part of the Bureau's broad fundamental research program on the constants, properties, constitution, and structure of macromolecular substances, vital to the development of standards for polymers and to improved or new uses of rubbers, plastics, and fibers.

Born in Russia in 1891, Dr. Madorsky received his B.A. in chemistry and physics from the University of Chicago in 1919 and his Ph.D. in 1923. Subsequently he joined Gathmys Research Corp. He was a Du Pont Fellow in research at the University of Chicago during 1928 and 1929. Thereafter he was associated with the Department of Agriculture before joining the NBS staff in 1940.

A member of the American Chemical Society, the Washington Academy of Sciences, and Sigma Xi, Dr. Madorsky has written extensively in his field and holds 12 United States patents.



Samuel L. Madorsky

Firestone in Akron U. Talk

In a commencement address at Akron University on June 10, Raymond C. Firestone, president, The Firestone Tire & Rubber Co., Akron, O., told assembled graduates that their opportunities are "greater than any preceding generation has ever known."

He pointed out that incentive is essential to success and that most incentive comes from within the individual.

"This we call self-interest," he said, "but self-interest must be so controlled that it takes into consideration the rights and interests of others."

Nichols Fine Chemicals

Nichols Chemical Co., Ltd., Montreal, P.Q., Canada, will build a new plant for the manufacture of a diverse line of industrial fine chemicals at its Valleyfield, P.Q., production center.

According to E. P. Aikman, vice president and general manager, the new facilities will produce metallic and alkali fluoborates and fluorides, as well as many inorganic salts, including nitrates, sulfates, and acetates. The rubber, plastics, automotive, and uranium industries are among those that will be served.

In building and operating the new plant, the company will utilize the technical assistance of its United States affiliate, General Chemical Division, Allied Chemical & Dye Corp., a major producer of fine and reagent chemicals.

Heyden Newport Plant

Heyden Newport Chemical Corp., New York, N. Y., is constructing a new plant at Pensacola, Fla., to produce methyl isopropyl catechol, a new turpentine-based chemical which is said to be a low-cost, efficient stabilizer for synthetic rubber.

The compound also has application as an antioxidant for petroleum products, as a polymerization inhibitor for polyester resins where the property of modifying viscosity and decreasing gel time is important, and as a chemical intermediate for insecticides and herbicides.

The new plant has a projected capacity for 500,000 pounds of the compound a year and is expected to be completed in October. An exclusive process for the production of methyl isopropyl catechol will be used, the company says.

Heyden Newport is currently building a new rubber chemical research laboratory at Pensacola.

Wedge-Grip in Tan Color

Wedge-Grip, a "three-deck" package conveyor belt introduced last fall by The Goodyear Tire & Rubber Co., Akron, O.,[1] is being made available in a tan color, in addition to the conventional black, for service where a sanitary appearance is desirable, according to the company.

The belt is designed with ribs in three-size stages on the belt cover, affording it gripping power to carry all types of packages on inclines up to 35 degrees. The ribs form small, open-center diamond patterns on the belt surface and are constructed with a step-down design so that as each step wears down, a new rib is presented for use.

The tan-colored belting is being manufactured in square-edge slabs up to 60 inches wide and 500 feet long. Belts will be delivered with edges coated with the same tan color as the rest of the belt.

[1]See RUBBER WORLD, Sept., 1956, p. 918.

New Fomrez Facilities

Witco Chemical Co., New York, N. Y., has put into operation new facilities for the production of raw materials for urethane foam manufacture at its Emulsol Chemical Division plant in Chicago, Ill. These new facilities are said to be completely equipped with automatic controls.

This new installation will more than double the company's capacity for Fomrez products. Witco-developed polyesters used to make flexible urethane foams. These products are sold through the organic chemical division of the company.

Future plans of the company call for production of raw materials for rigid urethanes as well as a hydrophylic polyester. Included among the products now being made in Chicago are Fomrez 50, a recently introduced polyester for urethane foam, and Witco 77-86, a coupler for these foams.

Cycolac Plant in Operation

Borg-Warner Corp., Chicago, Ill., has begun operations at its new $10-million plant for the production of Cycolac resin, its first large-scale investment in the plastics field. It will be known as the Woodmar plant.

Located on a 322-acre site near Parkersburgh, W. Va., about 130 miles southwest of Pittsburgh, the plant has access to a 3,500-foot frontage on the Ohio River for the receipt of incoming shipments of raw materials.

Eventually the facilities will consist of a group of individual fireproof buildings dispersed for maximum safety. The plant is being operated by the company's Marbon Chemical Division, which will continue to produce Cycolac resin at two other plants in Gary, Ind.

Cycolac resin is described as having the toughness of rubber and approaching the surface hardness of most non-ferrous metals. Its applications include plumbing pipe, sports equipment, watchcases, valve seats in oxygen masks, and industrial equipment.

New Jet Has BFG Tire

A tire developed by B. F. Goodrich Aviation Products, Akron, O., is being used on the new Lockheed F-104 jet fighter series. A ventilated tread design, dubbed "Sinewave," is said to be the key to the tire's highly rated performance.

The tread pattern is effective under extreme loads, on take-offs, and at landings at speed above 200 miles an hour, Goodrich reveals. The design allows heat to flow uniformly from the tire, while spacious grooves between the ribs circulate cooling air to eliminate formation of localized "hot spots."

The new tire is tubeless and is reinforced with multiple plies of nylon cord. This tire measures 26 by 6.6, with a 14-ply rating. It is about the same size as a passenger-car tire, but carries approximately 10 times the load and is inflated to 175 pounds per square inch.

Samuel W. McCune, III

E. Paul Hartsfield

Named to Du Pont (UK)

Samuel W. McCune, III, eastern district sales manager of the elastomer chemicals department of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., has been named general sales manager of Du Pont (United Kingdom), Ltd. E. Paul Hartsfield has been appointed sales manager of the eastern district.

Mr. McCune will be headquartered in London, England, and will be responsible for the overall sales activities of the new Du Pont subsidiary now building a neoprene plant near Londonderry, North Ireland. He has been eastern district manager for the past two years and was assistant manager of the development sales section prior to that. He joined Du Pont in 1940.

Assistant manager of the eastern district since 1955, Mr. Hartsfield formerly was sales supervisor of the New York sales office of the elastomers division of the organic chemicals department, which this year became the elastomer chemicals department. He joined the company in 1940 as an analytical chemist.

Firestone Plane Tires

A new line of airplane tires, incorporating features developed and tested on high-speed military jets, is being made available to civilian light plane owners, The Firestone Tire & Rubber Co., Akron, O., has announced.

The nylon cord tires are available in sizes from 5.00-4 to 11.00-12. The tires are said to have survived burst-tests at three times rated inflation. The tire stock is constructed of heat-resistant, long-wearing compounds, according to the company.

Dayton Gets Plastic Firm

The Dayton Rubber Co., Dayton, O., has acquired 99% of the stock of Cadillac Plastic & Chemical Co., Inc., Detroit, Mich., and four associated companies. The acquired group is said to be the nation's largest warehouse distributor of plastic sheets, rods, tubes, and other materials.

Cadillac Plastic holds national distribution rights for more than 25 major plastic and chemical brands. Its manufacturing division is the sole U. S. source of a variety of specialized plastic materials. The company will retain its corporate name and will continue to operate as a wholly independent subsidiary of Dayton Rubber.

Canadian Witco Formed

A Canadian company to manufacture and sell chemicals for the rubber, plastics, paint, and allied industries has been organized by Witco Chemical Co., New York, N. Y.

Called Witco Chemical Co., Canada, Ltd., it will have a Toronto, Ont., home office and a manufacturing plant in Trafalgar Township, southwest of Toronto.

William Wishnick has been named president and treasurer of the new company; S. M. Freeman, executive vice president; and H. B. Seligman, vice president.

The parent firm has 13 manufacturing plants throughout the United States and one in England.

Synthetic Rubber Seen on Brink of Fastest Growth

The synthetic rubber industry "is entering its greatest period of growth and will make a favorable impact on the future industrial progress of the United States," Raymond C. Firestone, president of The Firestone Tire & Rubber Co., Akron, O., said in announcing the fulfillment of a $35-million synthetic rubber expansion program at Firestone.

The expansion program included the construction of a 40,000-ton butadiene plant at Orange, Tex.; the expansion of a synthetic plant at Lake Charles, La., from 100,000 to 190,000 tons' capacity a year; and the expansion of Firestone's Akron, O., synthetic rubber plant from 30,000 to 40,000 tons a year.

The butadiene plant is the first to be built entirely by a rubber company. It will supply butadiene to the synthetic rubber plants at Lake Charles and Akron. Firestone's two synthetic plants had a capacity of 129,600 tons in April, 1955, when they were acquired from the government. Their present capacity is 230,000 tons a year.

Mr. Firestone listed three reasons for the synthetic rubber industry acquiring its present important stature in the American economy: the quality of synthetic rubber is now better than the natural product for many purposes; the supply of natural rubber is sufficient to meet only about two-thirds of the world's yearly demand for rubber; and the price of synthetic rubber has remained relatively stable while the price of natural rubber fluctuates and is dependent upon a number of uncontrollable factors.

U. S. Rubber Invests

United States Rubber Co., New York, N. Y., is investing a record $40 million during 1957 in the expansion and modernization of its plants and branches, H. E. Humphreys, Jr., president of the company, told a Philadelphia, Pa., audience attending ground-breaking ceremonies for a new $5 million branch and warehouse there in late June.

Mr. Humphreys also said that the company's replacement tire business is expected to set a record during 1957. Overall business outlook for the company was termed good.

Arco Building Polymer Lab

A $500,000, two-story laboratory devoted to the development of polymers for adhesives, plastics, coatings, and paints is being built at the Murray Hill, N. J., research laboratories of Air Reduction Co., Inc., New York, N. Y. The structure will be opened by the end of the year. Almost 100 people attended the ground-breaking ceremonies, which also marked the company's tenth year at the site.

Lyle I. Gilbertson, director of the laboratories, was master of ceremonies.

Using SBR, Not GR-S

E. I. du Pont de Nemours & Co., Inc., elastomer chemicals department, Wilmington, Del., according to the May, 1957, "News" publication of that department, will follow the recommendations of RUBBER WORLD and the American Society for Testing Materials and drop the term GR-S in favor of SBR and related nomenclature in the preparation of its technical literature. ASTM D1418-56T, "Tentative Recommended Practice for Nomenclature for Synthetic Elastomers and Latices," recommends the use of a new nomenclature for synthetic rubber based on the "R" family.

News About People

Donald O. Swan has been named assistant general manager of the manufacturing department of Esso Standard Oil Co., New York, N. Y.

R. M. Roach has been named New York district sales manager of Jefferson Chemical Co., Inc., New York, N. Y. **R. J. Robinson** has been transferred from Cleveland to New York; while **J. M. Luger** has been assigned to the Cleveland office, from Houston.

Herman Muehlstein, president of H. Muehlstein & Co., Inc., New York, N. Y., was awarded an honorary Doctor of Humane Letters degree by the University of Akron, being cited for his "notable contributions to the welfare of his fellow man."

Karl O. Nygaard has been appointed director of business research for The B. F. Goodrich Co., Akron, O., succeeding Dean E. Carson, now retired.

Copolymer Rubber & Chemical Corp., Baton Rouge, La., has announced the appointment of the following regional sales representatives: **A. E. Bailey,** who will serve the New England area, with headquarters at Hartford, Conn.; **F. T. Hults,** for the middle Atlantic states with headquarters in Philadelphia, Pa.; **M. D. Morris** and **B. G. Hutchison,** who will serve the Great Lakes and Midwest regions, with headquarters in Akron, O., and Chicago, Ill., respectively.

John H. Wotiz, since 1954 associate professor of organic chemistry at the University of Pittsburgh, has been appointed group leader in the exploratory research department of Diamond Alkali Co., Painesville, O., and will supervise research relating to acetylene chemistry.

Raymond F. Allen has joined Thermoid Co., Trenton, N. J., as vice president and director of marketing and sales. He was formerly vice president of sales at Stansteel Corp. and has been associated with Brewster Aeronautical Corp.

Leigh Photograph

Raymond F. Allen

Fred M. Stefan has been appointed executive vice president of Marbon Chemical Division of Borg-Warner Corp., Chicago, Ill.

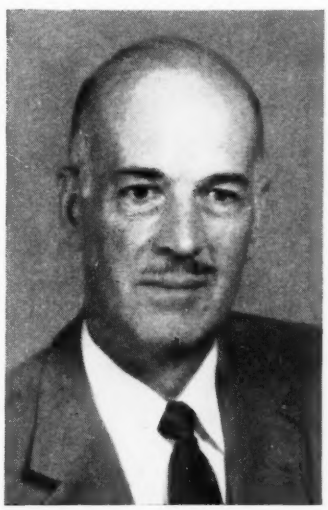
Rex H. Nielsen has been advanced to district sales manager of the Great Lakes area (with headquarters in Indianapolis, Ind.) for the industrial sales division of Thermoid Co., Trenton, N. J. **Martin D. Bates,** formerly sales supervisor of the Great Lakes district, has been named sales engineer in charge of national accounts, with headquarters in Chicago, Ill.

R. J. Thomas, vice president and treasurer, and a member of the board of directors of The Seiberling Rubber Co., Akron, O., recently celebrated his thirty-fifth anniversary with the company. He has held his executive positions since 1946.

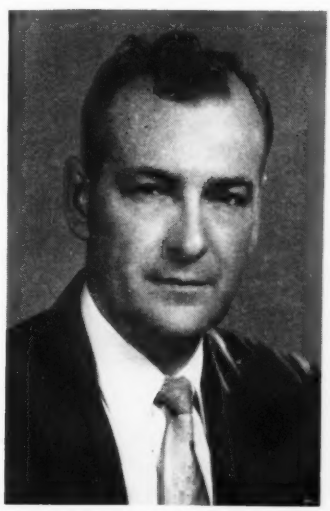
Henry M. Leigh has joined Diamond Alkali Co., Cleveland, O., as assistant to the controller. He was formerly budget director for Clevite Corp.

Jan Photographs

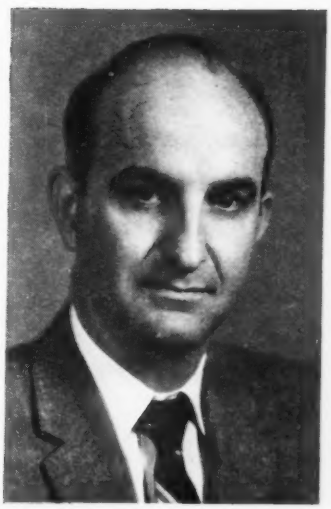
F. T. Hults



A. E. Bailey



M. D. Morris



B. G. Hutchison

Donald Strachan, since 1954 eastern sales manager for the Republic Division of Lee Rubber & Tire Corp., Conshohocken, Pa., has been appointed assistant to the president of the parent company. **William B. Dunlap, Jr.**, manager of Lee's laboratory and compound division, has been named manager of development and research for the company. **Ralph W. Deemer** has been advanced to factory manager; while **J. Paul Mathews** has been promoted to manager of development and research at the corporation's Republic Rubber Division, Youngstown, O.

Donald Strachan

Cornelius F. Sulliven, Amos J. Miner, and **James H. Aungst** have been appointed sales representatives for the organic chemicals division, Dewey & Almy Chemical Co., division of W. R. Grace & Co., Cambridge, Mass., and will headquarter in Cambridge, Chicago, and Atlanta, respectively. **Oscar W. Kaalstad** has been transferred to the San Leandro, Calif., sales office.

George K. Hinshaw, since 1939 vice president in charge of production for Goodyear International Corp., Akron, O., has retired after a 40-year association with the company. He has been succeeded by **Laurence H. Coffin,** his assistant since 1947.

R. I. Hoaglin, A. E. Montagna, and **H. W. Schultz** have been appointed associate directors of the development department at the South Charleston, W. Va., plant of Union Carbide Chemicals Co., division of Union Carbide Corp., New York, N. Y. **R. M. Berg** was named administrative assistant to the director.

Robert H. Tucker has been elected secretary of Minnesota Mining & Mfg. Co., St. Paul, Minn., succeeding **John L. Connolly,** who has reached retirement age, but who will continue as a director and general counsel. **Irwin R. Hansen** has been elected treasurer of the company, succeeding **Clarence M. King,** who has also reached retirement age, but who will continue to serve in an advisory capacity.

William B. Dunlap, Jr.

George R. Rabuse has been promoted to supervisor of product control, retail trades tape division, for Minnesota Mining & Mfg. Co., St. Paul, Minn. He joined the company in 1951 as a product control engineer.

James A. Nelson, senior staffman in the service sales and equipment division of The Goodyear Tire & Rubber Co., Akron, O., has been named manager of equipment sales in the division. G. P. White, manager of service sales in the retail stores division of the company, has been made manager of retread production and merchandising in the service sales and equipment division.

Frank T. Magennis, president of Goodyear International Corp., Akron, O., has received the Cuban Order of Highway Merit. He has been decorated previously by the governments of France, Peru, and Luxembourg.

George G. Stier, vice president in charge of the plastics division of Nopco Chemical Co., Harrison, N. J., has been honored for his 25 years of service to the company.

John J. Dacey, Jr., has joined United States Rubber Co., New York, N. Y., as sales promotion manager of its textile division. His immediate assignment will be on Trilok, the company's three-dimensional upholstery fabric.

George R. Vila, vice president and general manager of Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn., has been elected a member of the board of directors of the Manufacturing Chemists' Association.

M. G. O'Neil, executive assistant to the president and vice president of The General Tire & Rubber Co., has been elected a director of A. M. Byers Co., Pittsburgh, Pa., a majority of whose stock is held by Akron rubber company.

William E. Kavenagh, a pioneer member of The Goodyear Tire & Rubber Co. and widely known in the rubber industry, has joined J. M. Huber Corp., New York, N. Y., as a consultant. He was Goodyear's first rubber compounder and received the Paul W. and Florence B. Litchfield Award of merit for his part in developing Neolite in the early 1940's.

William E. Kavenagh

Merton D. Jones has been promoted to technical service supervisor for standard products, retail trades tape division, of Minnesota Mining & Mfg. Co., St. Paul, Minn.

S. F. Long has been named manager of the Chicago district sales office of the silicone products department of General Electric Co., Waterford, N. Y.

Leon J. Breton has been elected assistant vice president of American Mineral Spirits Co., Chicago, Ill. He was formerly manager of market research and development.

Herman Muehlstein, president, H. Muehlstein & Co., Inc., New York, N. Y., has been named chairman of the rubber division of the Greater New York Fund's current campaign.

James K. Buckwalter, since 1952 vice president in charge of sales for The Wooster Rubber Co., Wooster, O., has resigned. He joined the company in 1948 and has served on the company's board of directors.

Grant E. Russell has been named manager of the systems section of the engineering department of Monsanto Chemical Co.'s research and engineering division, St. Louis, Mo.

Dean J. Deakyne has joined Parker Appliance Co., Cleveland, O., as sales engineer to the New York Metropolitan Area including Connecticut.

W. Raymond Ahrberg

W. Raymond Ahrberg has joined the Akron office of Columbian Carbon Co., New York, N. Y. as technical salesman for its carbon black and pigment division. He replaces **William E. Ford,** who has been transferred to technical service, succeeding **Alden H. Davis,** newly appointed resident technical service manager in Sao Paolo, Brazil, for Cia. Petroquimica Brasileira-Copebras, in which Columbian Carbon has an interest.

Thomas J. Johnson has joined The Seiberling Rubber Co., Akron, O., as a staff engineer.

A. W. McNeil has been named northern mining district sales manager of the chemicals division of Canadian Industries, Ltd., Toronto, Ont., Canada. **F. E. Bradner** has been appointed western district sales manager for the division.

Albert J. Marshall has been named manager of the Dallas, Tex., branch of The Pioneer Rubber Co., Willard, O. He was head of his own company, Marshall Rubber Co., before joining Pioneer Rubber early this year.

L. G. Lumbers has been named vice president and general manager of Canada Wire & Cable Co., Ltd., Leaside, Ont., Canada.

J. J. Taylor has been appointed manager of market development and sales manager for Exon in the chemical sales division of Firestone Tire & Rubber Co. of Canada, Ltd., Hamilton, Ont., Canada.

E. A. Olander has been promoted to manager of merchandise and materials control at The Goodyear Tire & Rubber Co.'s Lincoln, Neb., plant, replacing **R. G. Olds,** who has been transferred to the company's Los Angeles, Calif., plant. **J. E. Law** has been named to succeed Mr. Olander as manager of industrial products merchandise distribution at Lincoln.

Carl H. Totsch, since 1951 sales manager of Midwest Rubber Reclaiming Co., East St. Louis, Ill., recently was elected also a vice president of the company. He started with the organization in January, 1946, in the purchasing and traffic department and advanced himself rapidly.

Howard R. Erwin, manager of Midwest's Paramount, Calif., plant, has been elected to the company's board of directors. He was a deputy director of the Office of Synthetic Rubber, Federal Facilities Corp., before joining Midwest in 1955.

Maxwell Photos

Howard R. Erwin

Frederick T. Hopkins has been appointed sales manager of industrial yarns and fabrics for the textile division of United States Rubber Co., New York, N. Y., succeeding **Albert W. Hansen,** who has retired. Mr. Hopkins joined the company in 1937 as a laboratory technician in its tire division.

M. Vernon N. Longtin has retired as president and general manager of Pirelli Cables Conduits, Ltd., St. Johns, P.Q., Canada, while remaining a director. **James A. Delanne** becomes the new president and will also assume the position of treasurer. **Ottarino C. Sarcoli** has been appointed general manager. **Miss Ruby M. Martell** has been elected a director.

Albert W. Dunn has been appointed manager of the aviation products department of The Goodyear International Corp., Akron, O. He was formerly with the aviation products division of The Goodyear Tire & Rubber Co.

Paul Beebe, Sr., in charge of foreign operations compounding for The Goodyear Tire & Rubber Co., Akron, O., has been awarded a diamond-studded service pin in commemoration of his fortieth year with the company. He joined Goodyear in 1917 as a chemical engineer, was named chief chemist at the company's Los Angeles plant in 1928, manager of the Akron process development department in 1935, and to his current position last year.

Robert M. Austin has been named plant superintendent at Illiopolis, Ill., for the Poyco-Monomer department of Borden Co.'s chemical division. He was formerly acting superintendent.

Maxwell Photos

Carl H. Totsch

R. L. Williams has been advanced to assistant chief engineer of the automotive division of The Timken Roller Bearing Co., Canton, O.

William S. Richardson, president, The B. F. Goodrich Co., Akron, O., was awarded an honorary degree of Doctor of Laws by Alabama Polytechnic Institute. He was cited for his contribution to the development of the South.

A. A. Douglas and **R. R. Failla** have been reassigned to the Albany and Buffalo district offices, respectively, of Union Carbide Chemicals Co., New York, N. Y. Also reassigned were **H. R. Hubbs,** to Charlotte; **C. D. Schmidt,** to Newark; and **R. J. Spath,** to Chicago.

E. W. Kaufmann has been appointed exclusive representative in the Philadelphia area for Baker Castor Oil Co., New York, N. Y.

William R. Tice has been appointed western belting engineer for the conveyor and elevator belting department of United States Rubber Co., New York, N. Y.

Clarence Wallace, once Lieutenant Governor of British Columbia, has been elected a director of Phillips Electrical Co., Ltd., Brockville, Ont., Canada.

Edward R. Bartley has been advanced to manager of marketing research for B. F. Goodrich Tire Co., Akron, O. He joined the company in 1953 as a statistician.

Kelvin T. Bacon and **Thomas J. Lyons** have been elected assistant treasurer and assistant secretary, respectively, of Minnesota Mining & Mfg. Co., St. Paul, Minn.

Harris & Ewing

Dean E. Carson

Dean E. Carson, director of business research for The B. F. Goodrich Co., Akron, O., has retired after 37 years of service with the company. He became associated with Miller Rubber Co. in 1920; the firm was merged with Goodrich in 1930. He was a member of the advisory committee of the War Production Board Rubber Division during World War II and has served in other governmental advisory positions.

Richard W. French, Jr., formerly vice president in charge of production for Standard Oil Co. of Ohio, has been elected president of United Carbon Co., Charleston, W. Va. He succeeds **Thomas A. Whelan,** who will remain as treasurer and chairman of the executive committee.

S. J. Pappalardo has been appointed merchandising services supervisor of the polymer chemicals division of W. R. Grace & Co., Clifton, N. J.

John H. Long, since 1953, assistant comptroller of The Goodyear Tire & Rubber Co., Akron, O., has received a 45-year service emblem from the company.

E. A. Bowditch, formerly eastern regional sales manager of The Dayton Rubber Co., has been appointed sales manager, distributor operations, of the cushioning division of the company, with headquarters in Asheville, N. C.

Paul J. Sullivan has been named resident manager of the Philadelphia sales branch of National Aniline Division, Allied Chemical & Dye Corp., New York, N. Y.

John D. Paulus has been appointed public relations director of The Firestone Tire & Rubber Co., succeeding **William D. Hines,** who has retired.

Richard W. French, Jr.

Clifford S. Farmer has been advanced to assistant controller of The B. F. Goodrich Co., Akron, O., succeeding **Kenneth Huffman,** who has retired after 37 years of service with the company.

Collier W. Baird, Jr., vice president of Baird Rubber & Trading Co., Inc., New York, N. Y., is on a three-month tour of the important rubber growing and trading centers of the Far East.

News Briefs

Polymer Corp., Ltd., has begun construction of the major building in a new specialty latex handling plant adjoining its main plant facilities in Sarnia, Ont., Canada. The three-story structure will be about 100 feet square and will contain a processing area, office space, personnel facilities, and a loading area. Total cost is put at $190,552. For Canadian foam sponge production, the consumption of latex has more than tripled between 1951 and 1956, the company says.

Firestone Industrial Products Co.'s Airide air springs operated without evidence of wear for 600,000 to 700,000 miles in recent tests on cross-country buses and trucks, the company reports. The average set of steel springs will give service for about 125,000 miles.

United States Rubber Co., New York, N. Y., played host to 1,200 officials of railroads, steamship lines, trucking fleets, airlines, and forwarding companies at its Rockefeller Center exhibit hall, May 22.

J. M. Huber Corp.'s *Huber News,* Spring, 1957, issue, includes an article on the history of gardens and the development of seed packaging, accompanied by an actual packet of 100 hybrid zinnia seeds. The quarterly publication also features a discussion of the company's new sales organization for the rubber industry.

The Firestone Tire & Rubber Co., Akron, O., will manufacture giant tires from synthetic natural rubber for testing by U. S. Army Ordnance. The all-Coral rubber tires will be size 24.00-25, more than six feet tall and weighing half a ton, the largest 100% synthetic rubber tires ever built by the company.

The Goodyear Tire & Rubber Co., Akron, O., is building the rubber-bladder fuel cells for the Marine Corps' "Ontos," said to have more firepower than any other land combat vehicle in history. The fuel cell is designed to fit around the drive shaft of the vehicle, is resistant to aromatic fuels, and has a 47-gallon fuel capacity.

Dow Chemical Co., Midland, Mich., will donate about $300,000 for the 1957-58 academic year as part of its continuing aid-to-education program, in addition to matching its employes' contributions to educational institutions up to $100 a year per employe.

S. B. Penick & Co., New York, N. Y., has acquired the aromatic chemicals compounding department of Dow Chemical Co., including manufacturing facilities at Jersey City, N. J., formulae, trade names and patents, and the entire physical inventory of merchandise and equipment.

American Latex Products Corp., Hawthorne, Calif., has received the Gold Award of the National Federation of Advertising Agencies for the "best overall advertising program of 1956," the highest of 36 awards made by the association at its recent Texas convention.

Davison Chemical Co., division of W. R. Grace & Co., Baltimore, Md., reveals that its line of fine-sized silica gels can be used to increase the bonding strength of adhesives. The addition of 5% of Syloid 75, an intermediate density gel, to the synthetic rubber solvent-type adhesives increases bond strength from 85 to 2,000, the company declares, citing one example.

American Brake Shoe Co. has moved its New York, N. Y., offices to 530 Fifth Ave.

Enjay Co., Inc., New York, N. Y., is making available an Enjay Butyl Filler Selector in form of a 3- by 6¼-inch slide-chart containing information on the use of a wide variety of fillers for Enjay Butyl 218 and 325.

New York Rubber Corp., New York, N. Y., has been awarded a $230,000 contract by the Philadelphia Quartermaster Depot for U. S. Army waterproof clothing bags.

Link-Belt Co., Chicago, Ill., has moved its New York, N. Y., district office to 530 Fifth Ave.

B. F. Goodrich Industrial Products Co. at its Marietta, O., Koroseal plant site is completing construction of additional manufacturing and warehousing facilities.

The Goodyear Tire & Rubber Co., Akron, O., is manufacturing to request specifications such highly specialized conveyor belting as those with Vanner or flanged edge ¾-inch high, V-guide ribs, and cleats with various dimensions and spacing lengths.

Aldan Rubber Co. employes have organized their own credit union to serve 175 personnel members of the Philadelphia, Pa., firm and their families. Savings will be pooled, and personal loans made at low cost.

Roger Williams Technical & Economic Services, Inc., Princeton, N. J., has opened an office in Havana, Cuba, for carrying out consulting chemical market research and economic studies throughout Latin America.

Falls Engineering & Machine Co., Cuyahoga Falls, O., has presented its fifth Industrial Arts Award to the senior of Cuyahoga Falls High School who leads his class in industrial arts aptitude. Falls Engineering President Harry L. Wright is an alumnus of the school.

Ware Chemical Corp., Westport, Conn., has been organized by John Ware, formerly vice president of Kenrich Corp., for the purpose of producing a complete line of accelerator dispersions and other specialties for the rubber and plastic industries.

Campco Division, Chicago Molded Products Corp., Chicago, Ill., has licensed Bakol S.A. Industria E. Commercio, Sao Paulo, Brazil, to manufacture Campco-type thermoplastic sheet in a variety of materials.

Mercury Molding Machinery, Inc., has been formed by Mercury Industries, Inc., Hillsdale, N. J., and Thomas M. Dodds for manufacturing machinery specifically designed for the molding of vinyl plastisols and other related plastics.

I. B. Kleinert Rubber Co., New York, N. Y., gave its annual luncheon for the trade June 5 at the Hotel Sheraton-Astor, New York, N. Y. Roland H. Guinzburg, president, addressed the 1,000 merchandise managers and infants' wear buyers who were present.

Reliance Electric & Engineering Co., Cleveland, O., opened for public inspection its recently built East Coast distribution center in Elizabeth, N. J. The Newark district office of Reliance and its Reeves Pulley Division are housed at the site.

Financial

Cooper Tire & Rubber Co., Findlay, O., and subsidiaries. First quarter, 1957: net earnings, $51,363, equal to 20¢ a share, contrasted with $108,527, or 42¢ a share, in the 1956 period; sales, $5,214,283, against $5,465,315.

Dayton Rubber Co., Dayton, O. Six months ended April 30, 1957: consolidated net earnings, $917,205, equal to 95¢ a common share, compared with $1,093,299, or $1.29 a share, in the like period last year; net sales, $37,356,158, against $34,-321,742.

The Eagle-Picher Co., Cincinnati, O. Six months ended May 31, 1957: net income, $2,421,847, equal to $2.41 a share, compared with $3,677,627, or $3.65 a share, in the six months ended May 31, 1956; net sales, $62,317,357, against $58,-999,627.

Firestone Tire & Rubber Co., Akron, O., and subsidiaries. Six months ended April 30, 1957: net income, $28,430,380, equal to $3.44 a common share, compared with $27,140,605, or $3.33 a share, in the 1956 period; net sales, $550,422,328, against $532,070,658.

Lee Rubber & Tire Corp., Conshohocken, Pa., and domestic subsidiary. Six months ended April 30, 1957: net earnings, $713,587, equal to 84¢ a capital share, against $736,495, or 86¢ a share, a year earlier; net sales, $21,794,591, against $21,-487,434.

Glidden Co., Baltimore, Md., and subsidiaries. Nine months ended May 31, 1957: net earnings, $5,388,561, equal to $2.34 a capital share, against $5,689,909, or $2.48 a share, in the 1956 period; net sales, $168,460,132, against $166,358,909.

Rome Cable Corp., Rome, N. Y. Year to March 31, 1957: net profit, $2,255,819, equal to $4.04 a share, compared with $2,023,070, or $3.82 a share, in the preceding fiscal year; net sales, $52,790,055, against $56,996,682.

A. G. Spalding & Bros., Inc., Chicopee Mass. Six months ended April 30, 1957: net profit, $473,000, equal to 78¢ a share, contrasted with $155,000, or 27¢ a share, a year earlier.

Taylor Instrument Cos., Rochester, N. Y. Nine months to April 30, 1957: net profit, $1,099,385, equal to $5.82 a common share, contrasted with $435,740, or $2.31 a share, a year earlier.

Thermoid Co., Trenton, N. J., and subsidiaries. Initial quarter, 1957: net income, $309,805, equal to 34¢ a common share, against $377,617, or 42¢ a share, in the like period last year; net sales, $9,652,801, against $9,417,871.

United Carbon Co., Charleston, W. Va. March quarter, 1957: net income, $1,-574,469, equal to $1.32 a share, against $1,558,518, or $1.31 a share, in '56.

Wallace & Tiernan, Inc., Belleville, N. J. Three months ended March 31, 1957: net earnings, $637,845, equal to 48¢ each on 1,327,260 capital shares, compared with $513,554, or 41¢ each on 1,248,757 shares, in the 1956 months; sales, $10,935,839, against $10,179,202.

West Virginia Pulp & Paper Co., New York, N. Y., and subsidiaries. Six months to April 30, 1957: net profit, $5,846,000, equal to $1.13 a common share, compared with $9,129,000, or $1.79 a share, a year earlier; net sales, $92,986,000 against $95,555,000.

Westinghouse Electric Corp., Pittsburgh, Pa. First quarter, 1957: net profit, $14,-198,000, equal to 82¢ a preferred share, contrasted with net loss of $18,575,000 in the 1956 period; net sales, $475,686,000, against $225,366,000.

Mexico

Mexico's imports of natural and synthetic rubber made further gains in 1956; the total came to 23,528 metric tons, against 22,805 tons in 1955 and 21,470 tons in 1954.

News from Abroad

Malaya

NR Outlook Bright Despite SR Plans

News about the progress in plans for synthetic rubber production in various European countries and also in Japan is understandably causing concern in rubber circles here. Obviously not all connected with the natural rubber industry in Malaya share the optimism expressed by two important personalities who seem to agree that provided adequate supplies of natural rubber are available at a sufficiently favorable level for consumers, the natural rubber industry actually holds the trump cards.

At the recent general meeting of the Rubber Growers' Association the chairman, H. T. Karsten, stated that natural rubber could beat any threat from synthetic rubber especially in price, provided production costs were lowered by more planting and replanting to increase yields and keep down costs. Synthetic rubber must be produced from raw materials, he added; consequently there is a minimum below which its costs and hence price cannot fall.

G. M. Knocker, chairman of the board of Harrisons & Crosfield (Malaya), Ltd., on the eve of his retirement and departure from Malaya, expressed similarly hopeful views of the future for natural rubber and with the same proviso. He stressed, as the most encouraging feature for natural rubber, the fact that it requires vastly more capital to produce a ton of synthetic rubber than a ton of natural rubber. He made the point that private capitalists were not likely to risk creating such production capacity for synthetic rubber that, added to natural rubber output, a substantial total surplus would arise.

Occasionally there might be temporary surpluses due to errors in calculation by synthetic rubber manufacturers which might depress natural rubber prices for a time, but he did not expect such periods to be prolonged. World demand for rubber would be steadily increasing, and low prices would stimulate demand, he felt; and if at such a time producers had young, high-yielding rubber trees ready for tapping, the advantage would be with natural rubber. He went on to emphasize that only by substantially increasing high-yielding areas all the time, could natural rubber producers curb the creation of increasing facilities for synthetic output which manufacturers might feel obliged to provide to avoid rubber shortages as consumption increased.

Incidentally, Mr. Knocker defended the selling of rubber land for fragmentation, being the first to do so publicly. Discussing the matter at a farewell dinner given in his honor by the All-Malayan Estate Staff Union, he said sweeping general criticisms were wrong, since much depended on circumstances. It was not right, he felt, to be a land hog "simply because one was there earlier." As the population grew, the demand for land became more urgent, and the people who wanted land did not care to go to inaccessible places. Big companies, however, were in a position to open up new land and move away from towns and villages.

"The consequences of denying the people their wishes are serious," he reportedly warned.

Malayan/China Trade

The disappointingly small purchases of Malayan rubber made by Red China since the lifting of destinational control last year is ascribed by rubber dealers here to the fact that Red China has no agents in Malaya.

Although Malayan rubber has been freed for export to Communist China since June, 1956, that country has so far bought only about 10,000 tons from Malaya, almost all of it last year. China appears to have indicated that she is prepared to take 5,000 tons of rubber a month, but that she is reluctant to buy rubber from Malaya under present conditions for fear of upsetting the market by large purchases. This, she reportedly made clear, could be avoided if purchasing agents were stationed in Malaya.

After Chinese purchasing agents began to operate in Indonesia, it is stated, rubber exports to China jumped from 2,000 tons in January, 1957, to 8,000 tons in February. Now, it is learned, Malayan rubber traders are planning to petition the government to permit Red China—through the China Import & Export Corp. (the trade authority appointed by Peiping)—to station rubber purchasing agents in Malaya too.

Objections to Buffer Stock Proposals

The Malayan delegation to the Rubber Study Group Conference in Indonesia will include representatives of the government as well as of the rubber industry. The French proposal for stabilizing rubber prices, mentioned by an Indonesian mission visiting Malaya last April, has so far not been received with any degree of enthusiasm because it was vague and appeared to offer no concrete suggestions, only attempting to revive the idea of a buffer stock for rubber. There seems little likelihood that this idea, once before considered and rejected, will fare any better now than it did in the past, one gathers from recent press reports.

According to one of these, rubber experts are against a buffer stock for various reasons: America is said to hold a stock of natural and synthetic rubber enough for her own use for five years, and if she decided to release part of it, rubber prices could drop steeply. Then, again, the Malayan Government might be accused of rubber price fixing. On the other hand there is no surplus rubber in the world today necessitating a rubber stock; and, finally, governments of the rubber producing countries do not have the means to set up a fund with which to buy rubber for stockpiling.

Rubber Traders to Visit New York

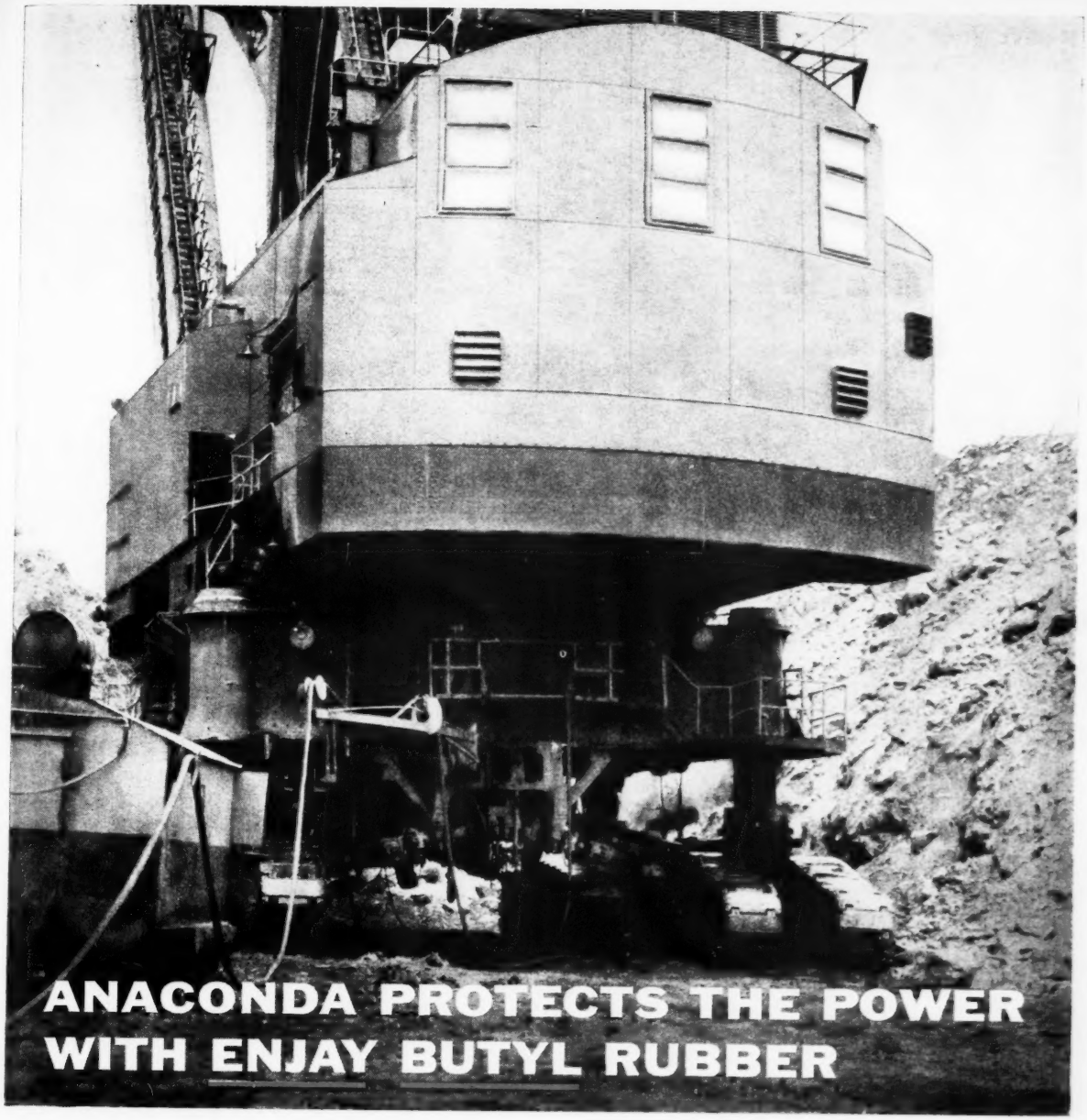
It is understood that certain members of the Malayan delegation to the conference held in London in May on disputes over quality and claims in packing are to fly to the United States for talks with the Rubber Trade Association of New York. According to a statement made in London by Tan Lark Sye, president of the Rubber Traders' Association of Singapore, an attempt will be made to persuade American rubber buyers to set up business in Singapore.

Ceylon

Rubber-Rice Pact Renewal?

With the rubber-rice pact, under which China agreed to pay Ceylon a premium over world market prices for rubber, now in its fifth and last year, the local rubber industry is worried about the future. It has benefited in several respects from the arrangement; the premium permitted the Ceylon Government to set up a Price Stabilization Fund and also to finance a Rubber Rehabilitation Scheme. Furthermore, because the government wished to avoid the frequent changes in the local purchase price of sheet rubber for China, which adjustment of world and contract prices involved, the price paid to producers frequently was above both the world and the contract price. This last benefit, at least, will end if China does not renew the agreement. Even if she does—and reports have it that she is eager to do so—terms are hardly likely to be as favorable as in the past, and the local purchase price will suffer accordingly.

Already the government saw itself forced in the middle of last March to cut the purchase price by 15 rupee cents per pound, since it had been dipping into the Price Stabilization Fund to maintain prices, and this fund was rapidly being exhausted. To be sure even with this cut, the price—1.25 rupees per pound for top grade—was above world level.



ANACONDA PROTECTS THE POWER WITH ENJAY BUTYL RUBBER

Talk about impact resistance! The 5-year-old Anaconda cable supplying this giant shovel with power was buried under thousands of tons of rock when a whole wall of the open pit mine caved in . . . *yet the cable continued to supply power!* This is one of the many Anaconda products featuring Enjay Butyl for *outstanding* performance.

Enjay Butyl is *unmatched* in its resistance to impact and abrasion, moisture and weathering, ozone and corona . . . properties that make it the world's outstanding rubber value.

Low in cost and immediately available in a grade tailor-made for *your* electrical application, Enjay Butyl is *the* rubber to boost performance and cut costs. For further information, and for expert technical assistance, contact the Enjay Company.

ENJAY BUTYL

Enjay Butyl is the world's greatest rubber value . . . the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

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Rubber Production Schemes

Under the Rubber Rehabilitation Scheme, which has now been in operation for four years, estates and smallholders were subsidized to replant old areas with high-yielding material, and total payments (made possible by the premium on rubber paid by China) have run to about 20 million rupees a year.

Meanwhile, two new schemes for improving the rubber-growing industry in Ceylon are being discussed. The first is a five-year plan drawn up by the Rubber Research Board of Ceylon aiming at lowering production costs by increasing output. To this end, high-yielding, disease-resistant clones would be planted; manuring, planting, and tapping techniques improved; and pathological research intensified; additional research stations would be set up, and a new Department of Plant Breeding established. The additional expenditure all this would require would be met by an increase in the cess.

Under the other plan, the government will alienate 16,500 acres of land for new planting of rubber by landless peasants who will be allotted two acres each and will also receive high-yielding planting material from the government. This scheme aims at making up for the 60,000 acres of uneconomic rubber which will shortly go out of production. Ceylon's present area under rubber is about 661,000 acres.

New Manufacturing Plants?

Once again there is talk about the establishment of a tire factory in Ceylon. On various previous occasions large foreign firms had been mentioned in connection with schemes to make automobile tires. This time a local company is said to have plans for making cycle tires and tubes. At the same time it is reported that a Chinese tire manufacturer in Singapore and a Japanese firm have also shown interest in this field and have made offers to the Ministry of Industries.

At present Ceylon imports about 250,000 cycle tires and tubes annually.

Trend Toward Socialism?

Since the recent change in government in Ceylon, the news has frequently been unsettling. What importance is to be attached to the various proposals for nationalization of industries and services (bus transportation and tea estates were specially mentioned) remains to be seen; they may or may not reflect the trend to the left against which leading members of the preceding government have been warning.

Certain unguarded statements by the present Prime Minister, implying the threat of strict measures against those who oppose his government, have provoked sharp retorts. The former Prime Minister told a large audience that if there were no organization and encouragement of the people to overthrow the incumbent government by democratic methods, it would be too late to prevent the country from being a slave to Communism. The section, "Commentary of the News of the Week", in the *Ceylon News* of March 14, states that the visit of Chou Enlai "was a great fillip to the left," and further that there has clearly been a change of heart within the government, and that the Prime Minister himself is said to feel that his party must "play the midwife to the painless birth of a revolutionary socialist state."

Germany

All LTP SBR Tire Treads

All passenger-car tires, including special tires for fast cars and sporting cars, produced by Continental Gummi-Werke A. G., Hannover, will have treads made entirely of synthetic rubber, it is learned. Deutsche Dunlop Gummi Compagnie, A. G. Hanau a.M., announced at the end of March that cold SBR will be used in the manufacture of treads for all sizes of ordinary passenger-car tires.

New Dunlop Mattress

Dunlopillo G.m.b.H., Hanau, recently produced a mattress from Dunloprene synthetic latex. The new mattress, marketed under the name Duprena, is said to be particularly elastic as well as reasonable in price, considering its qualities. It is made with a special corrugated wavy profile which, it is claimed, conforms to the body without it sinking in.

Rapid Literature Service

Since March 1, 1955, The German Plastics Institute, at Darmstadt, has been publishing on behalf of the Research Association for Plastics, Frankfurt a.M., a "Rapid Service" of Literature on Plastics as an aid to documentation in this field. The service has developed considerably in the meantime: whereas the first volume for 1955 included ten issues with 3,764 references, the second, for 1956, was made up of 12 issues with 6,524 references. In addition to German patents and individual papers, 117 domestic and foreign trade papers are regularly covered; of this number 46 are German periodicals, 61 are publications from Austria, Switzerland, Sweden, and the English-French-and Italian-speaking countries, and 10 from Slavic countries.

The service aims at presenting a worldwide survey of original articles on the latest developments in research and practice in the field of plastics and rubber, and in general on scientific discussions on the physics and chemistry of high polymers, one to two months after their appearance. In addition, new goods (chiefly from the United States) and general news of the industries involved are noted.

The collected abstracts appear once a month; during 1957 an issue is expected to run from 60 to 70 pages covering 500-600 items. The three numbers for the first quarter of 1957 have just been issued; they appear in MSS print on one side of sheets about 8¼ by 11½ inches and are obtainable from the Deutsche Kunststoff-Institute, Darmstadt.

Annual subscriptions for non-members is 200 DM; members of the Plastic Research Society pay 80 DM. When more than one copy is subscribed for, there is a rebate of 50% on the price of succeeding issues.

Czechoslovakia

Tire Plant for Indonesia

According to Czechoslovakian sources, Indonesia has ordered a complete tire-making factory from Czechoslovakia. Indonesia has a tire factory at Bogor, Java, but this has not been able to increase output to meet local demands, and tires cannot be imported in sufficient amounts to make up the deficit because of the shortage of the requisite foreign currency.

Symposium Invitation

The Czechoslovakian Chemical Society is sending out invitations to the International Symposium on Macromolecular Chemistry, arranged by the International Union for Pure & Applied Chemistry, to be held in Prague, September 9-15.

Australia

Much activity by automobile companies is reported in the province of Victoria, particularly in and around Melbourne. Among the companies mentioned as actually planning to produce entire automobiles or parts, or to expand existing facilities, are the Rootes group (producers of Humber, Hillman, and Singar cars), Volkswagen, Standard Car Co., Freighters Jeep, Ltd., and an Italian company, Tempo Matador. The Renault and Mercedes-Benz concerns are understood to be exploring possibilities.

Communist China

From time to time Red China announces that she is growing rubber trees within her boundaries. Now Peiping Radio is understood to have revealed that Chinese scientists have succeeded in growing more than 30,000 rubber trees capable of surviving at near freezing temperatures. This, it seems, is the initial result of research by the South China Sub-Tropical Plants Research Institute in transplanting rubber trees with the aim of developing a new species to be grown in the cold, northern regions of China.

(*Continued on page 610*)

4 NEW SUN RUBBER PROCESS AIDS

extend an already versatile list of products to fill all your processing requirements. Sun Oil Company's industry-leading list of high-quality products grows and grows to give you greater flexibility and economy in compounding and processing natural and synthetic rubbers.

PRODUCT		APPLICATION
CIRCOSOL 2XH. An elasticator of special hydrocarbon structures derived from petroleum.		Manufacture of oil-extended polymers. Plasticizer and softener for butadiene-styrene polymers, natural rubber, and combinations of both.
CIRCO LIGHT. A general-purpose, naphthenic type softener.		Manufacture of nonstaining reclaims and butyl inner tubes. Processing regular neoprene and natural rubber.
SUNDEX 53. A moderately aromatic product compatible with natural rubber, regular neoprene, and butadiene-styrene polymers.		Manufacture of oil-extended polymers. Processing tire tread stocks, rubber footwear, matting, toys, semihard rubbers, etc. Extending high Mooney Neoprene type WHV with a maximum loading of 50 parts per 100 parts neoprene.
SUNDEX 1585. A predominantly aromatic product compatible with natural rubber and butadiene-styrene polymers.	NEW	Particularly useful in the manufacture of oil-extended polymers where easy processing and optimum aromaticity are required.
SUNDEX 85. Highly aromatic product compatible with natural rubber, butadiene-styrene polymers, neoprene (regular and WHV), and acrylonitrile polymers.	NEW	Manufacture of low cost neoprene articles. Particularly useful for extending neoprene with exceptionally high loadings—75 to 100 parts Sundex-85 to 100 parts neoprene type WHV.
SUNDEX 170. A relatively aromatic product with a high molecular weight.		Manufacture of mastic floor tile, battery cases, and resinous binders.
SUNDEX 41. A complex, dark colored blend of high molecular weight petroleum fractions and a specially prepared asphaltum.		Processing natural rubber and butadiene-styrene polymers.
SUN PROCESS AID 515. A nonstaining, highly paraffinic type petroleum derivative with a low viscosity and fair processing ability.		Manufacture of butyl inner tubes. Processing natural rubber and butadiene-styrene polymers where color stability in the finished vulcanizate is important.
SUN PROCESS AID 551. A nonstaining, highly paraffinic type product with a low volatility, medium viscosity, and fair processing ability.	NEW	Manufacture of oil-extended polymers where nonstaining of the finished commercial article is important.
SUN PROCESS AID 594. A medium viscosity, naphthenic type petroleum derivative with a low volatility and good processing ability.	NEW	Manufacture of oil-extended polymers. Dry mixing process for natural rubber and butadiene-styrene polymers. Economical where some discoloration in the finished rubber can be tolerated.

For full information on these process aids and on Sun lubricants for rubber-process machinery, call your Sun representative or write to Dept. RW-7.

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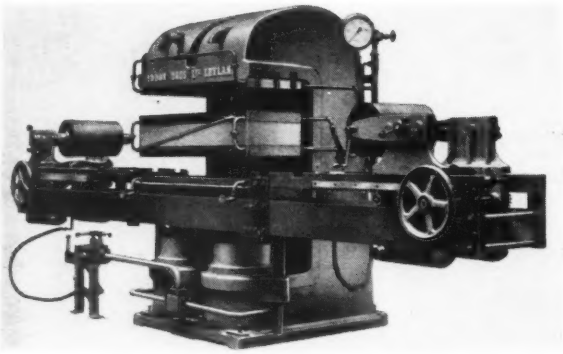
NEW EQUIPMENT



Iddon Bros. 18-inch by 48-inch hydraulic vulcanizing press for V-belts

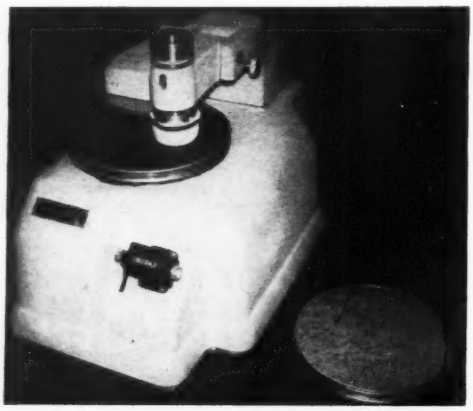
Hydraulic V-Belt Molding Presses

A new line of hydraulic V-belt molding presses is being offered in the United States and Canada by Iddon Bros., Ltd., Leyland, England, through its representative, Wilmod Co. Rubber Division, Toronto, Ont., Canada. The presses are available in a range of mold sizes, covering a series of belt circumferentials from 30-inch circumference to 400-inch circumference. Double-sided types are also available. Of cast construction and said to be of extremely robust design, each machine has a table complete with the stretching gear and is a self-contained unit that moves up and down with the center platen-mold.

Rubbing Wear Tester

A multi-directional abrasion tester for durability studies of such materials as shoe soles, boots and galoshes, floor finishes and coverings, and wallpaper and wallpaper cleaners whose use subjects them to a rubbing and twisting type of wear has been announced by United States Testing Co., Inc., Hoboken, N. J. The instrument achieves a complex rubbing and twisting action by contact of a reciprocating table, which holds the abrasive, and a rotary head to which the sample is attached. The instrument is equipped with a grit surface table and a rubber sheet table. Ring clamps on both the tables and the head permit substitution of a variety of additional surfaces. For example, floor coverings can be tested for wear with both shoe leather and cleansers.

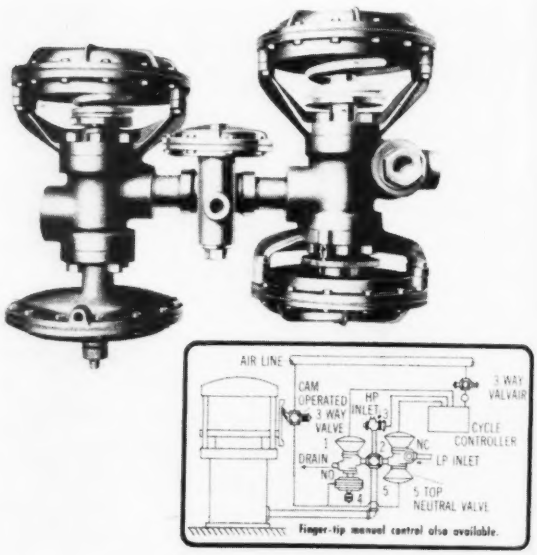
Provision is made for adapting the multi-directional abrasion tester for wet-and-dry tests as needed for evaluating washable wallpaper, rainwear, or floor waxes. Other features of the instrument include a stroke counter, a clearer brush, and an attachment for varying the pressure on a sample. This tester conforms to standards prescribed by the American Society for Testing Materials.



United States Testing Co.'s multi-directional abrasion tester

Todd Laboratory Mill

A new heavy-duty 6- by 16-inch laboratory mill for rubber and plastics processing has been announced by Todd Shipyards Corp., Los Angeles Division, San Pedro, Calif. It has 6- by 16-inch hollow rolls with internal spray, which are finished in bright hard chrome; a 7½ hp. gear-head motor drive with heavy-duty chain and sprockets; and a friction ratio of 1.23:1 with back roll turning at 19.7 rpm. Height of the mill is 58½ inches; width is 37½ inches; and depth is 29 inches. The height of rolls to center line is 48 inches.



Typical application of Sinclair-Collins automatic, 4,000-pound, 3-way, 2-pressure control valve

Fully Automatic Control Valve

A fully automatic, 4,000-pound, three-way, two-pressure control valve, designed for automated control of presses, plastic molding machines, and similar equipment has been announced by Sinclair-Collins Valve Co., Akron, O.

Upon actuation, the new valve applies low pressure for fast, controlled closing of the press or machine, after which, triggered by control timer interval or limit switch, the high pressure is applied. When processing is completed, high pressure cuts off, the drain valve opens, and the press or machine opens. The valve can be adjusted to provide any throttling speed in any position of the closing and/or opening strokes. An easily accessible, manually operated safety control permits instant reversal at any point in the closing phase of the cycle.

The valve has cast-bronze body, Monel metal stem with Stellite-faced seat and replaceable hardened stainless-steel seat sleeve. The valve is designed for use with Sinclair-Collins cycle controllers, with any suitable pneumatic or electro-pneumatic cycle control device, or for manual operation.

* *Everyone's talking about the new "cold," low Mooney polymer*

ASRC 3110!

Gives improved processing... better quality!

Rubber parts courtesy of Brown Rubber Co., Inc.

ASRC is now in production with a new, non-staining "cold," low Mooney rubber—ASRC 3110—which offers improved processing of molded and extruded sponge rubber parts. Users can expect easier mixing . . . smoother extrusion . . . faster extrusion rates . . . smoother calendering . . . less shrinkage.

ASRC 3110 also gives improved quality, such as better aging . . . higher tensile strength . . . and better hot tear resistance.

Literature and test samples available upon request.

ASRC

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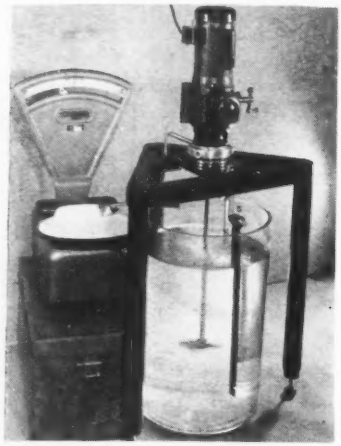
Chemineer Dynamometer Accessory For Experimental Agitator



ELB experimental agitator and dynamometer accessory

Chemineer, Inc., Dayton, O., is making available a new dynamometer accessory for its model ELB experimental agitator which provides for the direct determination of required horsepower for mixing non-Newtonian fluids and gas-liquids. Until now, horsepower requirements for these classes of fluids could only be estimated, the company says.

The accessory consists of a three-legged stand with adjustable leveling feet, a ball thrust bearing mounting for the ELB mixer, and a moment arm assembly which pivots from a bracket fastened to one leg of the stand. Motor torque is transmitted through the arm to the pan of a laboratory scale, where the amount of the force is displayed in pounds. Horsepower is determined accurately by substituting derived values in the standard horsepower formula.

New Automatic Net Weighing Machine From Exact Weight Scale Co.

A new automatic net weighing machine, designed for use in very restricted overhead clearance areas, has been introduced by The Exact Weight Scale Co., Columbus, O. Designated Model 447-22-NW-1500, the machine consists of an even-balance precision industrial scale, an air-operated slide valve, a controller, and remote control station. The remote control station permits the machine to be operated as a fully automatic dump and refill cycle or as a semi-automatic, where the operator can set the machine to fill automatically and dump by hand-operated push-button switch.

To maintain a minimum of overhead clearance, an air-operated slide valve was designed to mount directly on the customer's storage hopper. A special dust seal on the valve is operated by an air cylinder mounted on the front of the slide valve. The dust seal is designed to raise and seal the valve when the supply hopper is being filled.

Model 447-22-NW-1500 net weighing machine

The scale employs an even-balance lever system with a visual indicator and dial. Each weighment can be observed, and the machine may be stopped on any load to check the accuracy visually.

Various sizes of the automatic net weighing machine are available.

Automatic "Memory Panel" Developed by Richardson Scale Co.

A fully automatic "memory panel" that provides for the automatic feeding, weighing, and delivery of ingredients to any of a series of mixers has been announced by Richardson Scale Co., Clifton, N. J. The system has a small control panel (Figure 1) which is installed for each mixer in the system, and mixer operators dial requests through these panels to the main "memory panel" (Figure 2). Besides controlling the exact

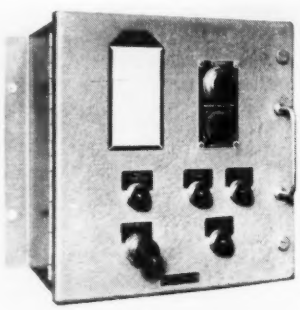


Fig. 1. Mixer control panel

Fig. 2. Main "memory panel"

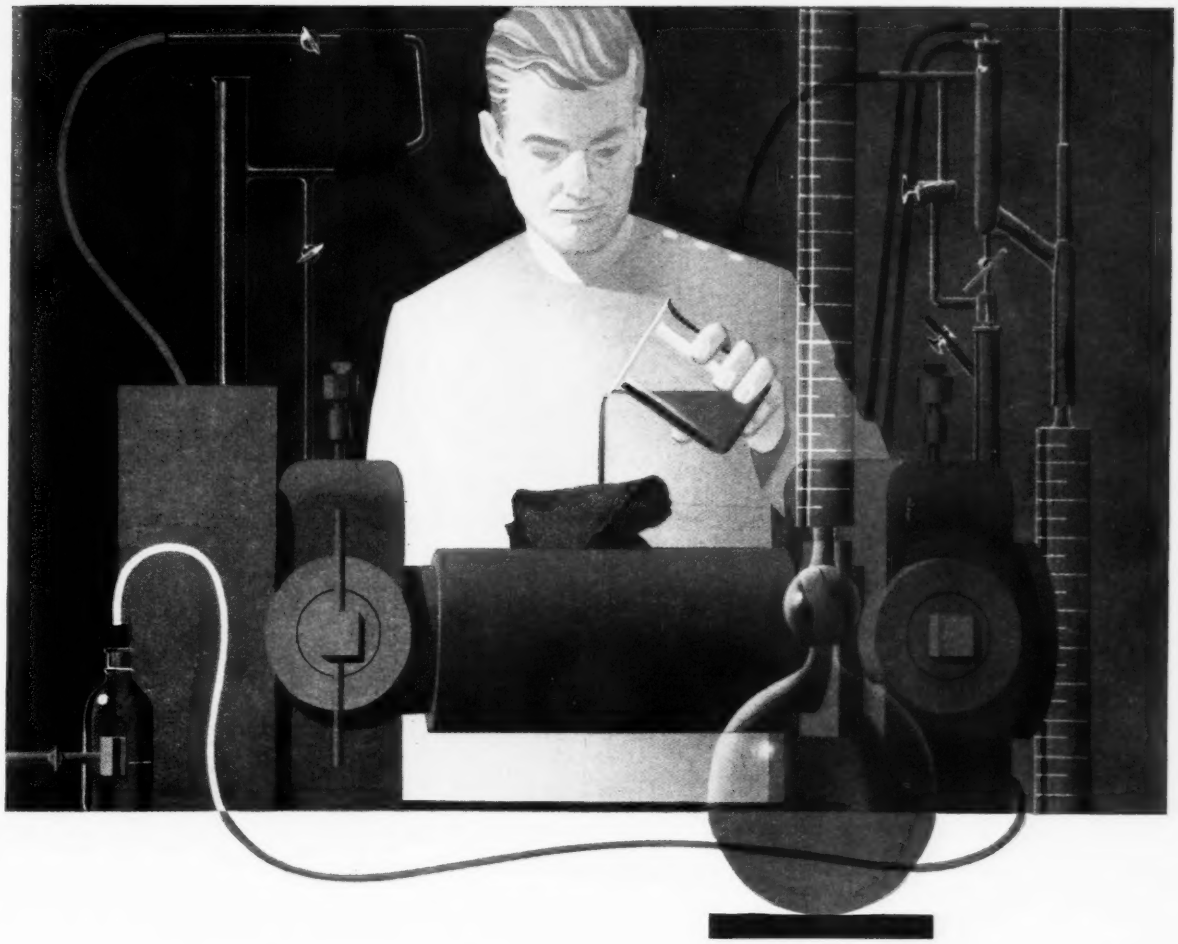
weight of each request and routing the weighing to the right mixer, the main panel keeps track of the sequence in which requests are received and makes weighings and deliveries in that sequence.

According to the company, the system is designed for manual as well as automatic operation. Manual operation requires an operator at the main control panels, to sequence the material by push-button controls through feeding, weighing, and delivery operations.

Controls at individual mixer panels include: a weight selector dial for each ingredient; a "batch request" button; and "acknowledgment light"; and light- and heavy-weight indicators. The main panel retains information from all the mixer panels, including specified weights and sequence of requests, until the weighing has cleared through the automatic scale and delivery system.

The complete system includes: screw, gravity or other feeding arrangements from the storage bin to the scale; an automatic hopper scale; and suitable delivery conveyors from scale to mixers. The main control panel includes: signal lights that trace the movement of each weighing for each weighing/delivery operation; mixer indicators, showing which mixer is receiving a weighing; light-heavy weighing indicators; and standard electrical interlocks between all components of the system.

"Industrial Ovens and Dryers." Bulletin 157, Young Bros. Co., Cleveland, O. 16 pages. The company's batch-type and conveyor-type ovens, air recirculating and heating systems, and control and safety equipment are described in this illustrated catalog. Also included are photographs of actual installations, a list of processes to which the equipment is applicable, and the titles of other available company publications.



Our Technical Service Laboratory Will Help You Build Better Products With Neville Resins

If you are not already using Neville coumarone-indene resins in the manufacture of your rubber products, it will pay you to request the assistance of our Technical Service Laboratory. Our chemists will work with yours in choosing the exact grade to suit your need. Neville coumarone-indene resins are ideal extender-plasticizers. They aid processing and add tensile strength and durability to finished compounds. Write for details.

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Resins—Coumarone-Indene, Heat Reactive, Phenol Modified Coumarone-Indene, Petroleum, Alkylated Phenol • **Oils**—Shingle Stain, Neutral, Plasticizing, Rubber Reclaiming • **Solvents**—2-50 W Hi-Flash, Wire Enamel Thinners.

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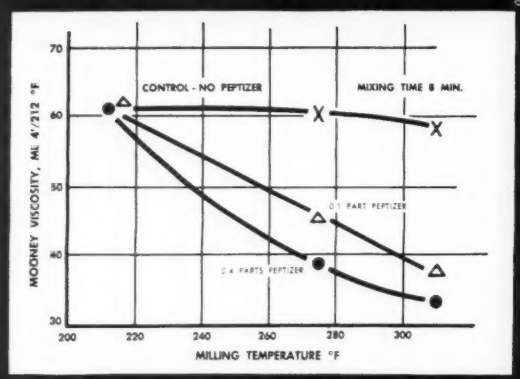
Introducing...

PITT-CONSOL PEPTIZER "620" and PITT-CONSOL PEPTIZER "640"

From our Newark reservoir of chemicals, PITT-CONSOL is now prepared to offer two highly effective peptizing agents to the rubber industry for laboratory or on-the-job evaluation.

The plot immediately below is illustrative of the high activity of PITT-CONSOL Peptizer "640" in natural rubber . . .



PITT-CONSOL Peptizers "620" and "640" have no deleterious effects on the compounded or cured properties—on rate of cure —or on age resistance.

We would be pleased to discuss these new products with you. Technical service, samples and data sheets are available.

• By a leading producer of high purity cresylic acids.

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NEW MATERIALS

Durez 16771 Molding Compound

A one-step, glass fiber reinforced, high-impact phenolic molding compound has been introduced by Durez Plastics Division of Hooker Electrochemical Co., North Tonawanda, N. Y. Called Durez 16771, it is said to be particularly designed to provide better resistance to hot oil immersion and aqueous acid conditions than the glass-filled phenolic molding compounds used heretofore. Durex 16771 is supplied in dry form normally as one-inch-long glass fiber rovings impregnated with a Durez phenolic resin.

Some reported properties of molded Durez 16771 follow:

Specific gravity	1.83
Molding expansion, in./in.	0.0009
Impact, Izod, ft. lb./in.	15
Flexural strength, psi	20,000
Tensile strength, psi	7,000
Compressive strength, psi	16,500
Distortion under heat, ° F.	600
Hardness, Rockwell, M scale	90

G-E Silicone Rubber SE-975

A new silicone rubber compound specifically designed for use as insulation on aircraft wire, motor and apparatus lead wire, Navy atomic cable, defroster, hook-up, and other wire applications has been introduced by General Electric Co., silicone products department, Waterford, N. Y. Designated SE-975, it meets MIL-W-8777, MIL-W-16878, and MIL-C-19381 specifications, and other applications in which good physical and electrical properties are requisite, according to the company. The compound is easy to freshen and can be milled for as long as 30 minutes without excessive tackiness. Furnished white, it may be tinted to obtain a wide range of colors.

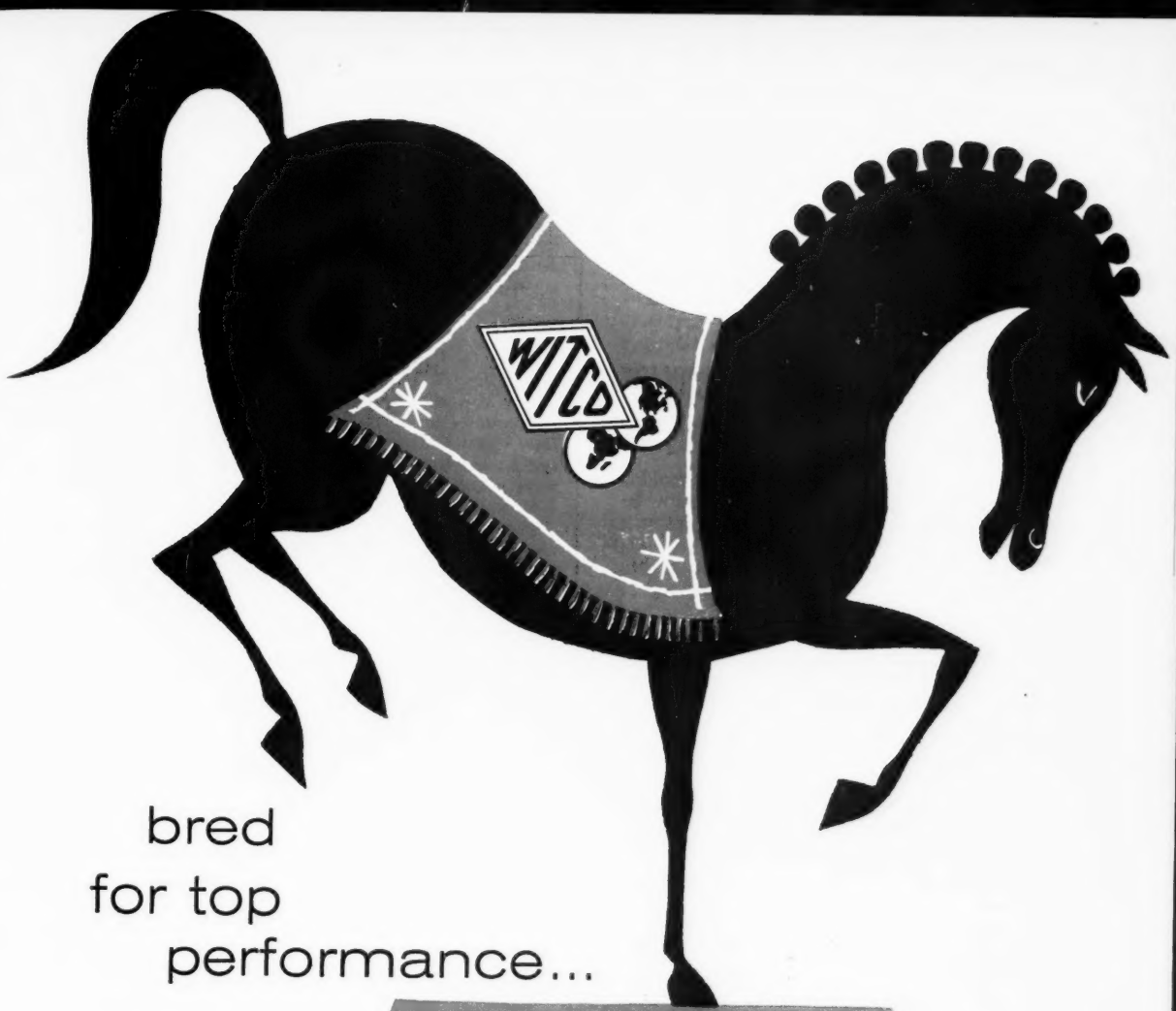
Some reported physical properties of SE-975, after oven cures at 300 and 480° F. are as follows.

	One Hr. 300° F.	24 Hrs. 300° F.	24 Hrs. 480° F.
Specific gravity	1.20	1.20	1.20
Hardness, Shore A	60	64	67
Tensile strength, psi	1,150	1075	775
Elongation, %	425	350	225
Toar strength, Die B, pi	125	120	90
Compression set, Method B, %, 22 hr./350° F.	—	—	19

Stauffer Trichloromethanesulfonyl Chloride

Research quantities of trichloromethanesulfonyl chloride, an organic sulfur derivative expected to find use in the rubber and chemical industries, are being offered by Stauffer Chemical Co., New York, N. Y. A white solid, stable at normal temperatures, but readily sublimed, the compound is soluble in a broad range of organic solvents. It has been found useful as a vulcanizing agent for styrene-butadiene rubbers and in the presence of elemental sulfur is a vulcanizing agent for natural rubber. According to the company, this compound should also prove to be a new and reactive intermediate in many fields of synthesis. The addition of 0.1% or more of trichloromethanesulfonyl chloride is reported to accelerate ignition and improve the lubricating qualities of diesel fuel oils.

The new compound has a molecular weight of 217.9, a melting point of 142° C., and a boiling point of 170° C. It



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for top
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continental
CARBON
BLACKS

There's a lot of "breeding" in the carbon blacks listed below—the result of 37 years' experience in serving the rubber industry by improving our manufacturing techniques to upgrade specifications. Always, the objective is to provide Witco-Continental Carbon Blacks consistent in quality, and meeting your range of compounding requirements. *Write for technical information and samples.*

Witco-Continental CARBON BLACKS

Furnace Blacks
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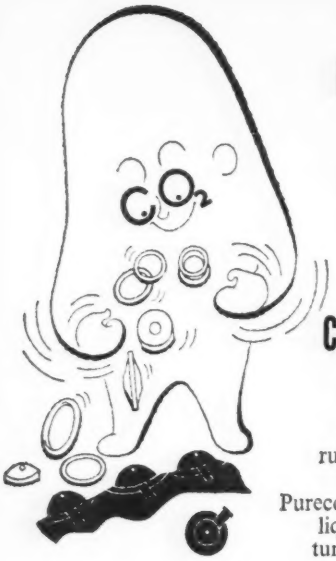

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is stable at normal temperatures and is not subject to easy hydrolytic decomposition as are most sulfonyl chlorides. It readily sublimes at room temperature. It is soluble in varying degrees in dimethyl formamide, acetone, chloroform, benzene, diethyl ether, acetic acid, methanol, and hexane, but has a negligible solubility in water.

Technical Bulletin No. 56-4, describing the properties and chemical reactions of the compound and listing bibliographical references, is available from Stauffer's market development department.

Silastics 6535 and 2017

Two new silicone rubbers for use as cloth-coating stocks at temperatures in the range of 600° F. have been introduced by Dow Corning Corp., Midland, Mich. Designated Silastic 6533 and Silastic 2071, they are said to be characterized by excellent bond strength, low compression set, and a high degree of resistance to reversion under clamps.

Silastic 6535 is a liquid dispersion, shipped ready for solution-coating on glass cloth. Vulcanized, it is reported to be one of the most temperature-stable elastomers known. It retains its resilience from 600° F. down to a brittle point of —178° F.

Silastic 2071 is designed especially for calendering, although it is also suitable for molding or extruding, Dow Corning says.

Both stocks are currently available in commercial quantities for such applications as hose and ductwork on jet engines, hot-air systems on aircraft, and similar industrial uses.

Some preliminary properties of the two silicone rubbers after a 24-hour vulcanization at 480° F. have been reported as follows:

	Silastic 6535	Silastic 2071
Hardness, Shore A	49	55
Tensile strength, psi	650	850
Elongation, %	210	250
Brittle point, °F.	—178	—100

Crown Dimethyl Sulfide

Dimethyl sulfide is being produced by Crown Zellerbach Corp., chemical products division, Camas, Wash., under exclusive license of a new process based on lignin which is said to have reduced the cost of the chemical, increasing its potential industrial applications. According to the company, Crown dimethyl sulfide is obtained in purer form than was ever commercially available before (more than 99% pure).

Dimethyl sulfide is expected to find use as a basic chemical or intermediate in organic synthesis and as a versatile solvent. It may be used as a sulfur carrier in rubber compounds and in natural gas odorants.

A water-white liquid with a distinctive, permeating odor, Crown dimethyl sulfide is reported to have the following physical properties:

Specific gravity	0.847
Melting point	—98.3° C.
Boiling range	99% @ 37.1° C.
Index of refraction	1.4349
Flash point	—34° C.
Heat of combustion	13,200 BTU per pound
Vapor pressure @ 0° C.	177 mm. Hg
10° C.	263 mm. Hg
40° C.	835 mm. Hg

A bulletin describing Crown dimethyl sulfide (DMS), giving its solubilities, detailing important chemical reactions, and listing literature references is available on request from the company.

"Presenting Lithium." American Lithium Institute, Inc., Princeton, N. J. 16 pages. The properties, uses, research potentials, and availability of lithium and its compounds are outlined in this booklet.

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NEW PRODUCTS

Multi-Purpose Industrial Tire

Goodyear's Super Rib

A new multi-purpose pneumatic industrial tire said to meet the growing need of a casing capable of a wide range of uses involving low- and high-speed highway service has been announced by The Goodyear Tire & Rubber Co., Akron, O. Called Super Rib, this tire is adaptable for such diverse uses as boat trailers, fork lift trucks, industrial tractors, mine cars, baggage loaders, aircraft servicing vehicles, and military material handling equipment.

Tubeless or tubed, the nylon corded tire is available in sizes ranging from 3.40/3.00 x 5, 2-ply, to 7.50 x 10, 12-ply rating. The tire features deep-cut slots in five saw-tooth riding ribs, which, during compression with driving surfaces, minimize spinning and skidding, according to the manufacturer.

Dual-Rating Butyl Wire and Cable

New Type RHH 90° C.-RHW 75° C. heat and moisture resistant, rubber insulated, and fibrous covered wire and cable is being made available by National Electric Products Corp., Pittsburgh, Pa. Designed for general use in wet or dry locations, the wire and cable is included in the 1956 National Electrical Code. It is listed by Underwriters Laboratories for 600-volt service in sizes 14 through 6 AWG.

The insulation is a butyl compound, Nepcozone Butyl, which is ozone and corona resistant, said to have been developed by the company. The new wire and cable is expected to find application in industrial plants and boiler rooms where heat and moisture may be present. Carrying a dual rating, the wire and cable is marked to indicate its use at Type RHW 75° as well as RHH 90°C. It also has designations every two feet to permit measurement.

Teflon-Lined Flanged Hose Assembly

A Teflon-lined flanged hose assembly for preventing liquids or gases from coming into contact with the metal portions of the fitting is being offered by Resistoflex Corp., Roseland, N. J. Called Fluoroflex-T flanged hose assembly (Type R5760), it is suggested for use with hot hydrochloric acid, hydrofluoric acid mixtures, sulfuric and nitric acids, and steam injector lines in acid operations, in essential oil operations, and in other applications. The assembly is available in a wide size range with hose having an inside diameter from ⅝-inch to 1⅜ inches.

The flanged coupling section is provided in modified ASA 150# forged steel flanges ranging in size from ½-inch to two inches. All sizes are available in standard 10-foot assemblies or smaller, and it is expected that longer assembly lengths will be available later.

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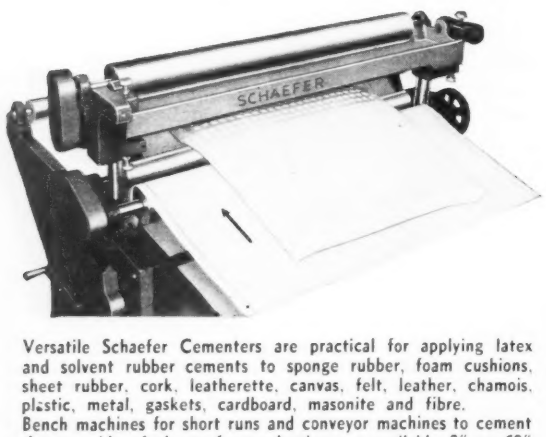

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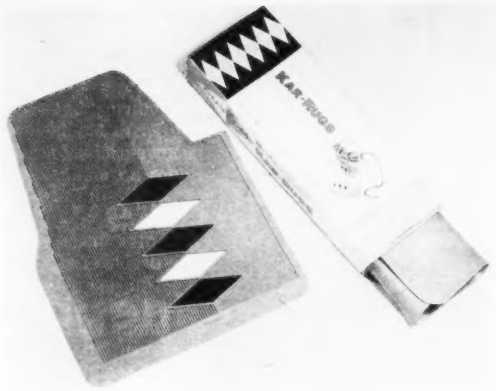

Custom Stylemaster Kar-Rug

Custom Stylemaster Kar-Rug

A new "luxury item" rubber automotive mat has been placed on the market by The Wooster Rubber Co., Wooster, O. Dubbed Custom Stylemaster Kar-Rug, it provides driver-side floor protection and is available in a choice of seven different colors, each with two contrasting color trims. The colors are blue, green, grey, red, white, brown, and black.

The undersurface design prevents slipping or sliding, and a raised ribbing design on the surface stops dirt and water from draining on the car floor and allows easy cleaning, according to the company.

Life-Saver Silvertown

Goodrich Tubeless

A 14- and 15-inch version of its Life-Saver tubeless tire has been placed on the market by B. F. Goodrich Tire Co., Akron, O. Called Life-Saver Silvertown, it is said to feature a wider-than-average tread that has 16 cross-cuts to the inch in the two outside ribs on each side. The three center ribs consist of molded-in zig-zag kerfs. Made with nylon cord, the new four-ply Life-Saver has puncture-sealing protection, a patented inner liner that slows down blowouts, and a simplified white sidewall.

Super Service 100

New Truck Tire

A new truck tire said to have been designed especially for operators of small or medium sized fleets has been introduced by The Seiberling Rubber Co., Akron, O. Called Super Service 100, the rayon cord tire's flatter tread increases road contact, thereby extending the life of the tread and the durability of the tire, according to the company. A deep, saw-tooth tread design prevents skidding. The tire is available in sizes from 8.25-20 through 10.00-22.

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TECHNICAL BOOKS

BOOK REVIEWS

"Textbook of Polymer Chemistry." By Fred W. Billmeyer, Jr. Interscience Publishers, New York, N. Y. Cloth cover, 6 by 9 inches, 518 pages. Price $10.50.

As its name implies, and, according to the author's statement, this book is intended as a text for "graduate-level courses in the chemistry of high polymers." It is divided into six parts, as follows: introduction (8 pages), physical chemistry of polymers (153 pages), kinetics of polymerization (101 pages), properties of plastics (89 pages), properties of fibers (51 pages), and properties of elastomers (78 pages). The book is further subdivided into short sections (57 in all), with the applicable references listed at the end of each section, where they are readily available. This volume also contains three appendices, viz., list of symbols, table of physical constants, and list of trade names, as well as an author and a subject index.

It is at once obvious that the author's undertaking was indeed an ambitious one, since he attempted to include not only the organic and physical chemistry of polymers, but the physical behavior aspects as well, all within the limit of 500-odd pages! The author makes no attempt to limit himself to the more elementary considerations, but includes the more advanced material as well. In view of this fact it is not surprising that the treatment accorded to each topic must perforce be very limited. The book itself can only act therefore as a "source book" of polymer chemistry for the purpose of directing the reader to the main literature sources. The material shows a good understanding of the basic principles by the author and is free of any serious errors or misconceptions.

It is a debatable point, however, whether a textbook should have the character of a source book, or whether it should be able to stand on its own feet. In the field of polymer chemistry, especially, an attempt to be all-inclusive presents insurmountable difficulties. The author himself states that "about one-third of all American chemists and chemical engineers are employed in industries dealing with polymeric materials." Furthermore, this field of "chemistry" is unique in that it deals with the effect of chemical constitution on physical behavior of structural materials. It may perhaps be justifiably argued that the role of a textbook is to correlate and interpret the vast amount of published material for the entering student, for whom "no prior knowledge of high polymers is assumed," according to the author.

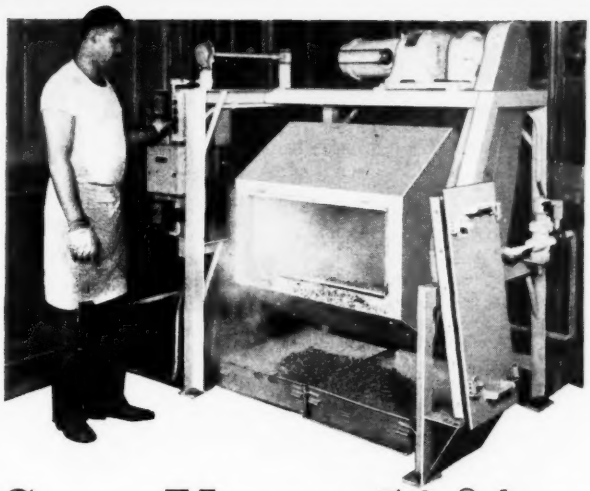
Actually, within the limitations of space, the author achieves a remarkably wide coverage of topics. The brevity of treatment, however is often extreme. The short introduction may be quite a shock to the novice in this field, since it immediately introduces, for example, the question of molecular weight averages, branched chains, crystallization, etc., all in the course of about three pages. In contrast, 70 pages are devoted to the section on the molecular and physical structure of polymers. Less than 90 pages are used to discuss the vast field of solution and bulk behavior, including molecular weight determination. The descriptive sections on the various plastics, fibers, and elastomers are rather limited, as might be expected.

As a textbook, it is rather breathtaking in its scope, though meager in its substance. It can, however, serve as an excellent source book, because of its wide coverage.

MAURICE MORTON

"La Stabilisation des Chlorures de Polyvinyle." (The Stabilization of PVC) By Fernand Chevassus and Roger de Broutelles, with a preface by Prof. L. Jacque, of Ecole Polytechnique, Paris, France. Published by Les Editions Amphora, 119 Ave. Parmentier, Paris XI. Vinyl imitation leather, 6¼ by 9¾ inches, 332 pages. Price, 3,500 francs, plus postage.

For the first time a book has appeared in which the stabiliza-



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tion of PVC has been thoroughly and systematically covered, both from the theoretical and the practical standpoints, so as to aid technologists not only in selecting the proper stabilizer for a given purpose, but also in understanding the mechanism of the degradation and stabilization of PVC.

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In the first of the two chapters of Part II is presented a fairly complete list of stabilizers, grouped according to chemical composition and with descriptions of their nature and uses; the second chapter discusses combinations of stabilizers and synergical phenomena.

Part III, in seven chapters, reviews methods of stabilization from a technological standpoint. Testing and the influence of the constituents of a mix (type of resin, plasticizer, filler, etc.), respectively, are dealt with in the first two chapters of this section; the succeeding five chapters take up specific applications: for electrical purposes; calendered products; rigid materials; plastisols and organosols; and paints and varnishes. References and patents are given at the end of each chapter throughout the work.

Finally, commercial stabilizers commonly used are listed under their trade names and arranged by manufacturers; both European and American firms are included.

NEW PUBLICATIONS

"Engineered Knives." Taylor, Stiles & Co., Riegelsville, N. J. 4 pages. The company's machine knives are described in this little illustrated folder.

"Polysar Introductory Bulletin." First Edition. Polymer Corp., Ltd., Sarnia, Ont., Canada. 20 pages. The properties and uses of the company's styrene-butadiene, nitrile, butyl, and special-purpose rubbers and latices are described in this booklet and compounding suggestions given. Included are recipes for a wide range of rubber goods, together with test data.

"American Synthetic Rubber Corporation." American Synthetic Rubber Corp., New York, N. Y. Contained in this folder are technical bulletins giving the specifications, descriptions, applications, and prices of the company's cold, hot, and cold oil-masterbatch styrene-butadiene rubbers, consisting of the following designations: ASRC 1000, 1001, 1004, 1006, 1009, 1018, 1019, 1500, 1502, 3110, 1703, and 1708.

"The Moving Force of Industry." Bulletin A-2501. Reliance Electric & Engineering Co., Cleveland, O. 8 pages. The company's complete line of a.c. and d.c. motors, gearmotors, motor-generator sets, motor controls, and packaged mechanical and electronic adjustable-speed drives is described in this illustrated catalog.

"This Is Blaw-Knox." Blaw-Knox Co., Pittsburgh, Pa. 52 pages. The organization and achievements of the company are the subject of this illustrated brochure. Blaw-Knox has five company divisions making fabricated products; eight plants producing foundry and mill machinery; a division which designs and constructs chemical processing plants; and a power piping and sprinkler division. It also has a company in France and one in England.

"Technical Data on Plastics." Fifth Edition. Manufacturing Chemists' Association, Washington, D. C. 224 pages. Price, $3.25. This handbook describes and catalogs the properties of all commercially available plastics. Graphical and tabular data on fabrication, durability, electrical, mechanical, and miscellaneous properties of 25 types of plastic materials are listed.

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STERLING BUILDING · STAMFORD, CONN.

Publications of Witco Chemical Co., New York, N. Y.

"Witco Fomrez No. 50." Technical Service Bulletin E-10, 2 pages. The properties of the company's polyester for flexible urethane foam production, as well as a typical recipe employing it and suggestions for compounding, are contained in this bulletin.

"Witco 77-86." Technical Service Bulletin H-5, 1 page. The physical properties and suggestions for use of this coupler for the production of flexible polyurethane foams are given on this data sheet.

Publications of Pennsalt Chemicals Corp., industrial division, Philadelphia, Pa.:

"Blends of Methyl and Ethyl Ultra-Accelerators to Reduce Bloom." S-122, 4 pages. Recipes incorporating the company's methyl and ethyl thiuram in nitrile rubber and SBR stocks to reduce bloom are given here, together with post-cure physical properties of the stocks.

"Merac in Latex Formulations." S-123, 8 pages. The physical properties, advantages, and compounding of the company's liquid accelerator for use in natural and synthetic latex formulations are covered in this booklet. Recipes and post-cure test data are given for *Hevea* latex films, natural rubber latex, SBR 2000 latex, neoprene latex, and Hycar latices.

"Preliminary Evaluation of Zinc Oxide in Latex Paint." Robert F. Schwartz. Technical Paper No. 19. American Zinc Sales Co., Columbus, O. 24 pages. This brochure covers the preliminary results of an investigation involving the advantages and disadvantages of the use of zinc oxide pigment in polyvinyl acetate latex paint. A tentative specification for a polyvinyl acetate latex to have maximum stability with zinc oxide is given. More than 40 latices of both homo and copolymer types were investigated for zinc oxide stability, and their chemical and physical properties are tabulated.

"Solux NS." A. L. Moran. Report No. 57-5. E. I. du Pont de Nemours & Co., Inc., elastomer chemicals department, Wilmington, Del. 14 pages. The company's new non-discoloring, non-staining solid antioxidant is described in this technical report. Solux NS is said to be outstanding in all types of light-colored elastomer products, providing excellent protection against the deteriorating effects of heat and oxygen, yet causing an absolute minimum of discoloration and staining. Recipes incorporating the waxy solid cream-colored antioxidant in natural, SBR, and neoprene rubber stocks, and in natural rubber latex and a blend of Hypalon 20 and natural rubber are given.

"Symposium on Tension Testing of Non-Metallic Materials." Special Technical Publication 194, American Society for Testing Materials, Philadelphia, Pa. 82 pages. Price, $2. This is a compilation of papers presented at a symposium sponsored by ASTM Committee E-1 on Methods of Tests. Included are five papers on the testing of rubber, plastics, adhesives, wood, and paper. The objectives of the symposium were to give an accurate summary of present practices in fields where tension testing is most widely used and to present a critical appraisal of their merits and deficiencies, and to act as a guide to future development and standardization.

"Operations Research—a Basic Approach." Special Report No. 13, American Management Association, New York, N. Y. 112 pages. This book is adapted from nine papers on operations research originally presented at AMA orientation seminars in Chicago and New York last year. The authors discuss operations research without excessive dependence on mathematical formulae and show the results obtained to date in a number of industries. Operations research is described in the allocation of resources, in product distribution and multi-plant scheduling, in an engineering laboratory, in aircraft maintenance, as a functional corporate job, and in terms of new developments and applications.

"Griptite Package Belt." Bulletin 2550-A. B. F. Goodrich Industrial Products Co., Akron, O. 2 pages. The company's new Griptite conveyor belt for moving both light and heavy packages is described and illustrated in this catalog section.

"Epoxy/'Thiokol' Liquid Polymer Coatings." Thiokol Chemical Corp., Trenton, N. J. 8 pages. Formulae, test data, suggestions for compounding, and methods of application of the company's Thiokol liquid polymer-modified epoxy resin systems for use as protective coatings on ships, aircraft, machinery, and railroad cars are contained in this technical booklet.

"Expand/Aligner." C. A. Litzler Co., Inc., Cleveland, O. 4 pages. This illustrated bulletin describes the functioning of the company's bowed-roll unit in automatically controlling expansion, total width, selvage spacing, and centering of tire cord and other open-weave fabric webs during processing.

"Rotary Batch Blenders." Brochure BL-157. Sturtevant Mill Co., Boston, Mass. 4 pages. Specifications on the company's nine models of rotary batch blenders and suggestions for installation are contained in this illustrated bulletin.

"How a Profitable Plant Was Built." Badger Mfg. Co., Cambridge, Mass. 8 pages. This illustrated brochure describes the styrene plant the company designed and built for Cosden Petroleum Corp., Big Spring, Tex. The plant is the first built which recovers ethylbenzene directly from gasoline.

"70th Anniversary Report." Arthur D. Little, Inc., Cambridge, Mass. 36 pages. The achievements of the company during 1956 in fundamental research, technology, and business services are reported on in this annual report by President Raymond Stevens and his staff.

"Spray Booths." Catalog I-7000. The DeVilbiss Co., Toledo, O. 36 pages. Specifications and functions of the company's wide range of spray booths are given in this illustrated catalog. Advice on selecting the right kind of spray booth is included.

"TDI Detector Kit." Bulletin No. 0811-4. Mine Safety Appliances Co., Pittsburgh, Pa. 2 pages. A portable detector kit for determining low concentrations of toluene diisocyanate and TDI-urea vapors in plants manufacturing polyurethanes is described in this bulletin.

"Process Control." Tracerlab, Inc., Waltham, Mass. 36 pages. This handbook on radiation gaging of a wide variety of materials describes the company's sensing, positioning, registering and control, and output units, which are illustrated. Advice on selecting a gaging system and case histories of some of the company's installations are also included.

Air Force Polymer Program

(Continued from page 545)

tensile strength would need to be 18,000 psi. (curve 2). These extrapolations are based on the SE-740 slope. If we base our extrapolations on the butyl rubber slope (curve 3), a room temperature tensile strength of 7,000 psi. would be required for 500 psi. at 750° F. Of course, aging at temperature for periods as long as eight hours would further increase the slope of these curves.

It is apparent from these data that new polymers must be found which exhibit more horizontal tensile-temperature slopes before truly thermally stable elastomers can be developed. Although considerable progress has been achieved over a six-year period toward the development of thermally stable organic elastomers, it is expected that a considerable longer period will be required for the development of new systems stable to 750 or 1000° F.

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MARKET REVIEWS

Synthetic Rubber

American producers of synthetic rubbers established a new monthly high in May when they made 95,049 long tons of all types. The previous record was 94,389 long tons, produced in March, 1956. Consumption of synthetic rubber in May amounted to 79,710 long tons, which was not a record, but the ratio of synthetic to total new rubber consumed at 63.25% was, according to the monthly report of The Rubber Manufacturers Association, Inc. New rubber consumed in May totaled 126,029 long tons, compared to 121,193 long tons in April.

Natural rubber consumption in May amounted to 46,319 long tons, compared with 45,072 long tons used in April; and consumption of reclaimed rubber reached 23,800 long tons in May, compared with 22,947 tons for April.

SBR consumption in May climbed to 66,335 long tons from the 63,131 long tons used in April. Consumption of this rubber during the first five months, however, has been at a good level, and a lower consumption during June, July, and August is quite likely. SBR production in May was 77,160 long tons, a considerable increase from the 65,147 long tons produced in April. Exports at 12,400 long tons were also higher than the 11,500 long tons exported in April.

Production and consumption of neoprene rose somewhat in May over April figures. Butyl production was slightly higher; consumption about the same, and exports higher. Nitrile production, consumption, and exports also rose slightly in May.

The consumption of SBR oil-extended rubber has been increasing at a steady rate and now amounts to about 39% on a net polymer basis, as compared with 33% a year or more ago. Carbon black and oil-black masterbatches have not shown any such gain during the past year.

The outlook for a very good year for synthetic rubber continues good.

Natural Rubber

Quiet, featureless conditions continued to characterize the natural rubber market during the May 16-June 15 period. Only 16,850 tons of rubber were traded on the New York Commodity Exchange, about the same as during the previous period. Spot prices in New York scarcely fluctuated, registering less than a 1¢-a-pound high-low price differential.

According to trade sources, the causes of the continued lull were more or less the same as they were during April and May: the lag in automotive sales; the relative peacefulness of international affairs; the lag in buying on other world markets.

Statistically, on the New York Commodity Exchange, of the 16,850 tons traded, all were in the Rex Contract. May sales amounted to 14,000 tons. There were 21 trading days during the May 16-June 15 period.

Week-end closing Commodity Exchange future prices for the Rex Contract were as follows:

REX CONTRACT

	May 17	May 24	May 31	June 7	June 14
May	32.20	31.58	31.40	32.55	33.30
July	32.05	31.38	31.20	32.36	32.90
Sept.	31.80	31.27	31.00	32.10	32.65
Nov.	31.45	31.08	30.80	31.95	32.40
1958					
Jan.	31.25	30.93	30.00	31.75	32.20
Mar.	31.05	30.70	30.40	31.55	32.00
May	30.85	30.50	30.20	31.35	31.80
Total weekly sale, tons	4,020	2,250	1,780	5,510	6,470

On the physical market, RSS 1, according to the Rubber Trade Association of New York, averaged 32.44¢ a pound for the May 16-June 15 period; 32.18¢ for the month of May; and 32.74¢ for the first half of June. Other average May spot prices for representative grades were: RSS #3, 31.62¢; #3 Amber Blankets, 28.06¢; and Flat Bark, 21.84¢.

NEW YORK PHYSICAL MARKET
WEEK-END CLOSING PRICES

	May 17	May 24	May 31	June 7	June 14
RSS: #1	32.50	32.00	31.88	32.63	33.25
2	32.00	31.50	31.50	32.38	33.00
3	31.50	31.00	31.13	32.13	32.75
Pale Crepe #1 Thick	36.50	36.00	35.88	36.63	37.00
Thin	35.50	35.00	34.88	35.63	36.00
#3 Amber Blankets	28.00	28.00	28.13	29.25	29.88
Thin Brown Crepe	27.88	27.75	27.88	29.00	29.63
Standard Flat Bark	21.75	21.38	21.38	21.75	22.25

Latex

Interest in natural rubber latices continued very low during the May 16-June 15 period, making supplies somewhat easier. Trade sources cited the still disappointing sales of 1957-model automobiles as the chief reason for the slight demand. Synthetic latices were also not up to their anticipated sales levels. The doldrum is expected to continue through the summer months, as productive activity slides owing to vacations and similar factors.

Prices for ASTM Centrifuged Concentrated natural latex, in tank-car quantities, f.o.b. rail tank cars, ranged during the period from 40 to 43¢ per pound solids. Prices of synthetic latices were steady at 22 to 32¢ for SBR; 37 to 47¢ for neoprene; and 44 to 54¢ a pound for N-types.

Final March and preliminary April domestic statistics for all latices were reported by the United States Department of Commerce as follows:

(All Figures in Long Tons, Dry Weight)

Type of Latex	Production	Imports	Consumption	Month-End Stocks
Natural				
Mar.	0	5,856	7,081	10,173
Apr.	0	...	6,455	12,032
SBR				
Mar.	7,227	41	6,370	7,689
Apr.	6,306		5,522	8,303
Neoprene				
Mar.	924	0	784	1,170
Apr.	976	0	734	1,095
Nitrile				
Mar.	1,127	0	799	2,157
Apr.	881	0	603	1,394

Reclaimed Rubber

Activity in the reclaimed rubber market during the May 16-June 15 period was at lower levels than during the previous period, according to trade sources. Overall May business was seen to have been poorer than in April. These conditions are expected to improve somewhat during the entire month of June. Beyond that, summer vacations and shutdowns will take their usual toll of business.

Reclaimed rubber prices were unchanged.

RECLAIMED RUBBER PRICES

Whole tire: first line	$0.11
Fourth line	.0975
Inner tube: black	.16
Red	.21
Butyl	.14
Pure gum, light colored	.23
Mechanical, light colored	.135

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

Scrap Rubber

There was little activity in the scrap rubber market during the May 16-June 15 period, and industry sources believed the lull would continue until Labor Day.

Scrap rubber exports were higher in March than they were in February, according to the Census Bureau, United States Department of Commerce. March exports totaled 4,466,095 pounds, worth $234,001, compared with the 3,629,339 pounds, valued at $143,694, shipped the month before. For the first quarter of this year exports totaled 11,930,708 pounds.

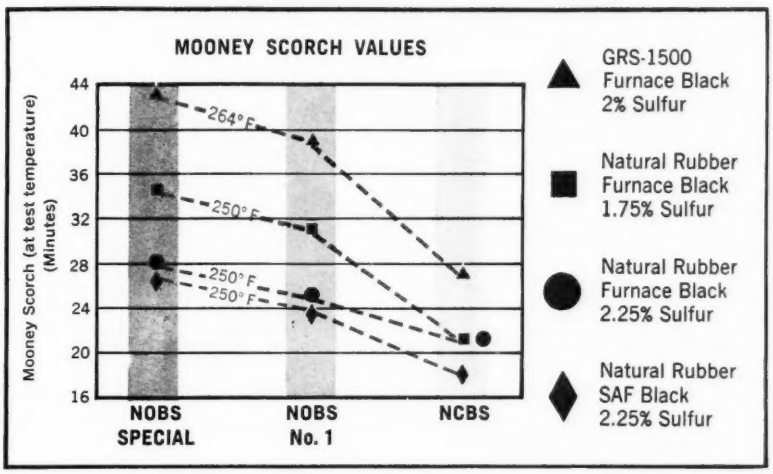
Scrap rubber imports for February totaled 1,311,114 pounds, worth $50,993.

CYANAMID RUBBER

Chem Lines

NO. 11 OF A SERIES Published by AMERICAN CYANAMID COMPANY, Rubber Chemicals Department, Bound Brook, New Jer

Beating Hot-Weather Scorching with Delayed Action Accelerators



The danger of scorching in susceptible stocks always rises along with summer temperatures. At these times the delayed action accelerators, NOBS* No. 1 and NOBS* SPECIAL, are particularly useful since they are designed to compensate for the high processing temperatures and scorching tendencies.

The considerable increase in processing safety imparted by NOBS Accelerators is diagrammed above. The chart shows, for different stocks, the high protection of NOBS SPECIAL, the somewhat lower protection afforded by NOBS No. 1 and the still lower protection afforded by NCBS (*N*-cyclohexyl benzothiazole-2-sulfenamide). In each case the compounding was identical except for the type of accelerator used.

Averaging the several tests, it can be found that processing safety, as measured by the Mooney Scorch Test, is 57% higher for NOBS SPECIAL and 39% higher for NOBS No. 1 than for NCBS in equivalent compounds. This extra margin of scorch protection can mean much in rubber compounding; may, in fact, be critical when higher ambient or processing temperatures further aggravate the scorch tendencies of high pH furnace blacks.

These scorch test data are taken from a series of tests in which cure characteristics were fully determined. Complete information on them is contained in Cyanamid's Rubber Chemicals Technical Bulletin No. 836, available to rubber compounders on request. In short, however, it may be stated that Rex Hardness, Creep, Modulus and Tensile Strength are substantially identical for the NOBS Accelerators and NCBS. No physical properties are sacrificed to obtain the extra processing safety.

NOBS Accelerators store well, maintain their specification activity for reasonable periods of time, and exhibit a very low order of toxicity. The cost is fully competitive with accelerators that offer less scorch protection and their use with activators often provides adequate safety at a lower compounding cost. Your Cyanamid representative will be happy to pass on to you all the relevant information on NOBS Accelerators that applies to your rubber processing.

Send now for Technical Bulletin No. 836, *Delayed Action Accelerators*, NOBS No. 1 *and* NOBS SPECIAL.

*Trademark

Gravities from "A to Z" in Handy Form

As a compounder, you will find a hand aid in the specific gravity tabulati available from your Cyanamid Rubb Chemicals representative. Approx mately 250 compounding ingredien are listed with the specific graviti shown for each. Accelerators and ant oxidants, available from sever sources, may have slightly differe gravities due to variations in proce or additives used. In these cases, a average gravity was listed since tl variations were within limits of e perimental error.

While this information is, of cours available in the literature, much tin can be saved by use of this concise lis To make its use even more convenien the card is printed on a tough plast and sized to fit a shirt pocket. Wi not much persuasion, you can get extr cards from your Cyanamid sales re resentative and display them, fro and back, at a convenient work are

From *Accelerators* to *Zinc Sulfid* the pocket list provides a handy con pounding check list as well as a sourc of specific gravity information. In an case, the Pocket Specific Gravity Cha may save time, avoid frustration, an lessen chances for error in experimen al or production compounding.

compared with 1,373,750 pounds, valued at $54,909, in January.

Prices of scrap rubber grades at mid-June were as follows:

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$10.00/13.00	$13.00
S.A.G auto tires	Nom.	Nom.
Truck tires	Nom.	Nom.
Peelings, No. 1	37.00	37.00
2	Nom.	Nom.
3	16.00	17.00
Tire buffing	Nom.	Nom.
	(¢ per Lb.)	
Auto tubes, mixed	2.75	2.75
Black	6.50	6.50
Butyl	3.75	3.75
Red	7.00	7.00

Industrial Fabrics

Prices of wide cotton fabrics for coating purposes displayed an uneven tone during the May 16-June 15 period, as buying continued on a relatively limited, spasmodic basis. With a limited volume of business being transacted in the market, some mills were reported to be shading prices in order to get orders.

Trading in cotton ducks continued at a steady pace, with overall volume good. Sizable lots of Army ducks and enameling ducks were sold by several mills for delivery late in the third quarter.

Period-end prices of industrial fabrics were as follows:

INDUSTRIAL FABRICS

Drills		
59-inch 1.85 yd.	yd.	$0.345
2.25-yd.		.295
Ducks		
38-inch 1.78-yd. S.F.	yd.	nom.
2.00-yd. D.F.		.30
51.5-inch, 1.35-yd. S.F.		.4675
Hose and belting		.69
Osnaburgs		
40-inch 2.11-yd.	yd.	.24
3.65-yd.		.1575
Raincoat Fabrics		
Printcloth, 38½-in., 64-60, 5.35-yd.	yd.	.135
6.25-yd.		.1175
Sheeting, 48-inch, 4.17-yd.		.20
52-inch, 3.85-yd.		.23
Chafer Fabrics		
14.40-oz./sq. yd. Pl.	yd.	.73
11.65-oz./sq. yd. S.		.61
10.80-oz/sq. yd. S.		.6575
8.9-oz/sq. yd. S.		.67
Other Fabrics		
Headlining, 59-in., 1.65-yd., 2-ply	yd.	.41
64-inch, 1.25-yd., 2-ply		.59
Sateens, 53-inch, 1.32-yd.		.535
58-inch, 1.21-yd.		.57

Rayon

Total packaged production of rayon and acetate filament yarn during May was 62,100,000 pounds, consisting of 32,500,000 pounds of high-tenacity rayon yarn and 29,600,000 pounds of regular-tenacity yarn. April production had been: total, 63,600,000 pounds; regular-tenacity yarn, 28,600,000 pounds; and high-tenacity rayon yarn, 35,000,000 pounds.

Total filament yarn shipments to domestic consumers came to 58,200,000 pounds, of which 28,800,000 pounds were high-tenacity rayon yarn and 29,400,000 pounds were regular-tenacity yarn. April shipments had been: total, 58,600,000 pounds; high-tenacity yarn, 31,300,000 and regular-tenacity, 27,300,000 pounds.

Total end-of-May stocks were 67,000,000 pounds, made up of 11,500,000 pounds of high-tenacity yarn and 55,500,000 pounds of regular tenacity yarn. End-of-April stocks had been: total 64,300,000 pounds; high-tenacity yarn, 8,600,000 pounds; and regular-tenacity, 55,700,000 pounds.

Prices of rayon tire yarns and fabrics in mid-June remain unchanged.

RAYON PRICES

Tire Yarns	
High-Tenacity	
1100/ 480	$0.59/$0.64
1100/ 490	.59/ .64
1150/ 490	.64
1165/ 480	.65
1230/ 490	.64
1650/ 720	.55/ .61
1650/ 980	.55/ .61
1875/ 980	.61
2200/ 960	.55/ .60
2200/ 980	.55/ .60
2200/1466	.64
4400/2934	.60
Super-High-Tenacity	
1650/ 720	.58
1900/ 720	.58
Tire Fabrics	
1100/490/2	.77
1650/980/2	.725
2200/980/2	.715

CALENDAR of COMING EVENTS

June 10-August 30
Gordon Research Conferences, Colby Junior College, New London, N. H. (Sessions on Elastomers, July 29-August 2.)

July 26
Chicago Rubber Group. Golf Tournament. Medinah Country Club, Medinah, Ill.

August 1
New York Rubber Group. Golf Outing. Baltusrol Golf Club, Springfield, N. J.

August 16
Philadelphia Rubber Group. Golf Outing. Manufacturers' Country Club, Oreland, Pa.

September 7
Connecticut Rubber Group. Grassy Hill Park, Shelton, Conn.

September 11-13
Division of Rubber Chemistry, ACS. Hotel Commodore, New York, N. Y.

September 12
Northern California Rubber Group.

September 18-20
National Bureau of Standards, Catholic University of America, Applied Physics Laboratory of Johns Hopkins University. Symposium—"Formation and Stabilization of Free Radicals." National Bureau of Standards, Washington, D. C.

September 23-25
American Society of Mechanical Engineers. Fall Meeting. Hotel Statler, Hartford, Conn.

September 26
Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.

September 30-October 5
ISO/TC 45. Seventh Meeting. Zurich, Switzerland.

October 1
The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

October 4
New York Rubber Group. Henry Hudson Hotel, New York, N. Y.
Detroit Rubber & Plastics Group, Inc.

October 8
Buffalo Rubber Group.

October 10
Northern California Rubber Group.

October 11
Chicago Rubber Group. Furniture Club, Chicago, Ill.

October 18
Boston Rubber Group. Hotel Somerset, Boston, Mass.

October 24
Southern Ohio Rubber Group.

October 25
Akron Rubber Group. Sheraton-Mayflower, Akron, O.
Philadelphia Rubber Group.

November 5
The Los Angeles Rubber Group, Inc.

November 7
Rhode Island Rubber Club.

November 14
Northern California Rubber Group.

November 15
Chicago Rubber Group.
Connecticut Rubber Group.

November 15-16
Southern Rubber Group. Peabody Hotel, Memphis, Tenn.

December 1-6
American Society of Mechanical Engineers. Hotel Statler, New York.

Are you measuring all the muscles in your base fabrics?

Fabric breaking strength is frequently given too much importance, when it is just one of at least seven kinds of strength that contribute to end-product performance!

Over-emphasis on one kind of strength can give a misleading picture of how a fabric-reinforced plastic or rubber product will behave. Depending on end use, the impact, shear, flex, tear, burst or stitch strength can be just as decisive as breaking strength. All together, they permit a much more dependable estimate of product capabilities.

When your base fabric is one of the many provided by Wellington Sears for coating, laminating, combining and rubberizing, you know that its strength *and all other properties* have been considered in the light of your specific need. And moreover you know that a century of experience is working for you, to anticipate and help solve your working-fabric problems.

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Synthetic Rubbers and Latices*

Monomers

Acrylonitrile	lb.	$0.27	
Butadiene	lb.	.15	
Dow Styrene N99, H99	lb.	.205	
RG	lb.	.17	
Vinyltoluene	lb.	.17	
Hylene M	lb.	3.50	$5.00
M-50	lb.	1.90	3.40
T	lb.	1.10	2.65
TM	lb.	.95	2.50
-65	lb.	1.00	2.55
Isobutylene	lb.	.38	
Isoprene	lb.	.25	
Monomer MG-1	lb.	1.00	1.25
Mondur-C	lb.	1.05	
-S	lb.	.85	
Multron R-2	lb.	.54	
Rohm & Haas ethyl acrylate	lb.	.34	.36
Glacial methacrylic acid	lb.	.45	.47
Methyl acrylate	lb.	.37	.39
Methacrylate	lb.	.29	.31

Shortstops

DDM	lb.	.75	.88
Mercaptan 174	lb.	.38	.50
Shortstop 204	lb.	.33	.37
268	lb.	.52	.53
Tecquinol	lb.	.825	.845
Thiostop K	lb.	.53	
N	lb.	.41	
Vulnapol KM	lb.	.52	.53
NM	lb.	.38	.42

Acrylic Types

Hycar 4021	1.35[c]
4501	.81[c]

Fluorocarbon Types

Kel-F Elastomer	lb.	15.00	16.00

Isobutylene Types

Enjay Butyl 035, 150, 215, 217, 218, 325	.23[a]
165, 265, 267, 268, 365	.24[a]
Hycar 2202	.65[c]
Polysar Butyl 100, 200, 300, 400	.245[c]
101	.2775[a]
301	.255[c]
Vistanex	.45[a]

Neoprene

Neoprene Type AC, CG	.55[a]
GN, GN-A, WX	.41[a]
GRT, S	.42[a]
KNR	.75[a]
W, WHV	.39[a]
WRT	.45[a]

Latices

Neoprene Latex 571, 842-A	.37[a]
572	.39[a]
60, 601-A	.40[a]
635	.41[a]
735, 736	.38[a]
950	.47[a]

Nitrile Types

Butaprene NAA	.54[a]
NF	.49[a]
NL	.50[a]
NXM	.58[a]
Chemigum N1NS	.64[b]
N3NS, N5	.58[b]
N6, N-6B, N7	.50[b]
Hycar 1001, 1041	.58[c]
1002, 1042, 1043, 1312	.50[c]
1014	.60[c]
1411	.62[c]
1432	.59[c]
1441	.64[c]
Paracril AJ	.485[c]
B, BJ, BJLT, BLT	.50[c]
C, CLT	.58[c]
CV	.59[c]
D	.65[c]
18-80	.60[c]
Polysar Krynac 800, 802, 803	.50[c]
801	.58[c]

Latices

Butaprene N-300	.46[b]
N-400, N-401	.54[b]
Chemigum 200	.49[b]
235 CHS, 236	.54[b]
245 B, 245 CHS, 246, 247	.46[b]
Hycar 1512, 1552, 1562, 1577	.46[c]
1551, 1561, 1571	.54[c]
1852	.44[c]
Nitrex 2612, 2614	.46[a]
2615	.51[a]

Polyethylene Type

Hypalon 20	lb.	$0.70

Polysulfide Types

Thiokol LP-2, -3, -32, -33	96[a]
-8, -38	1.25[a]
PR-1	.95[a]
Type-A	.47[a]
FA	.69[a]
ST	1.00[a]

Latices

Thiokol Latex (dry wt.)	
Type MF	.85[a]
MX	.70[a]
WD-2	.92[a]
-5	.95[a]
-6, -7	.70[a]

Silicone Types

GE (compounded)	$2.25[a]	4.10[a]
Silicone gum (not compounded)	3.85[a]	4.90[a]
Silastic (compounded)	1.95[b]	3.65[b]
(Partly compounded)	3.38[b]	3.90[b]
(Uncompounded)	3.85[b]	4.50[b]
Union Carbide (compounds)	2.35[b]	3.20[b]
(Gums)	3.85[b]	4.25[b]

Styrene Types†

Hot SBR‡

Ameripol 1000, 1001, 1006	.241[c]
1002	.2435[c]
ASRC 1000, 1001, 1004, 1006	.241[c]
1018	.270[c]
1019	.265[c]
FR-S 1000, 1001, 1004, 1006	.241[c]
1009	.2475[c]
1010	.26[c]
1012	.2425[c]
1013	.25[c]
1014	.281[c]
1015	.291[c]
Naugapol 1016, 1019	.265[b]
1018	.27[b]
1021	.30[b]
1022	.28[b]
1023	.285[b]
Philprene 1000, 1001, 1006	.241[b]
1009	.2475[b]
1010	.26[b]
1018	.27[b]
1019	.265[b]
Plioflex 1006	.241[c]
Polysar Kryflex 200, S, S-50	.241[c]
SS-250	.30[c]
S-X-371	.255[c]
S-1000, -1001, -1006, -1013	.23[a]
-1002, -1011	.2325[a]
Synpol 1000, 1001, 1006, 1007, 1061	.241
1002	.2435[b]
1012	.2425[b]
1009	.2475[b]
1013	.25[b]

† Listed below are the new SBR type synthetic rubbers and latices trade names and the chief sales offices of their producers or distributors.

Ameripol	—Goodrich-Gulf Chemicals, Inc., 3135 Euclid Ave., Cleveland 15, O.
ASRC	—American Synthetic Rubber Corp., 500 Fifth Ave., New York 36, N. Y.
Baytown	—United Rubber & Chemical Co., Baytown, Tex. (producer); United Carbon Co., Inc., Charleston 27, W. Va. (distributor).
Butaprene, FR-S	—Firestone Tire & Rubber Co., Synthetic Rubber Division, 381 Wilbeth Rd., Akron 1, O.
Copo	—Copolymer Rubber & Chemical Corp., P. O. Box 2595, Baton Rouge 1, La.
Naugapol, Naugatex	—Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.
Philprene	—Phillips Chemical Co. Rubber Chemicals Division, 318 Water St., Akron 8, O.
Plioflex	—Goodyear Tire & Rubber Co., Chemical Division, Akron 16, O.
Pliolite Latex	—Goodyear Tire & Rubber Co., Chemical Division. Also distributed by General Latex & Chemical Corp. 666 Main St., Cambridge 39, Mass.
Polysar	—Polymer Corp., Ltd., Sarnia, Ont., Canada (producer); H. Muehlstein & Co., Inc. 60 E. 42nd St., New York 17, N. Y. (distributor).
S-	—Shell Chemical Corp., Synthetic Rubber Sales Division 50 W. 50th St., New York 20, N. Y.
Synpol	—Texas-U. S. Chemical Co. Port Neches, Tex. (producer); Naugatuck Chemical (distributor).

‡SBR —Styrene-butadiene rubber.
§BR —Butadiene rubber.

Hot SBR Black Masterbatch

Philprene 1100	$0.194[b]
1104	.19[b]
S-1100	.185[a]

Cold SBR

Ameripol 1500, 1501, 1502	.241[c]
ASRC 1500, 1502	.241[c]
1503	.2625[c]
Copo 1500, 1502	.241[c]
1505	.261[c]
FR-S 1500, 1502	.241[c]
Naugapol 1503	.2625[b]
1504	.295[b]
Philprene 1500, 1502	.241[b]
1503	.2625[b]
Plioflex 1500, 1502	.241[c]
Polysar Krylene	.241[c]
S-1500, -1501, -1502	.23[b]
Synpol 1500, 1502, 1551	.241[b]

Cold SBR Black Masterbatch

Baytown 1600, 1601, 1602	.176[a]
Philprene 1600, 1601	.193[b]
1605	.19[b]
S-1600, -1601, -1602	.1825[a]

Cold SBR Oil Masterbatch

Ameripol 1703	.206[c]
1705	.2035[c]
1707	.191[c]
1710, 1712	.1885[a]
ASRC 1703	.206[c]
1708	.191[c]
Copo 1712	.1885[a]
FR-S 1703	.206[c]
1705	.2035[c]
1712	.1885[a]
Philprene 1703	.206[b]
1706	.203[b]
1708	.191[b]
1712	.188[b]
Plioflex 1703, 1773	.206[c]
1710, 1712	.1885[a]
1778	.191[c]
Polysar Krynol 651	.1885[a]
652	.191[c]
S-1703	.195[a]
1705, 1706	.1925[a]
-1707	.18[a]
-1709, -1712	.1775[a]
Synpol 1703	.206[b]
1707, 1708	.191[b]
1711	.19[b]

Cold SBR Oil-Black Masterbatch

Baytown 1801	.16[a]
Philprene 1803	.174[b]
S-1801	.1675[a]

Hot SBR Latices

FR-S 2000, 2001, 2006	.26[a]
2002	.285[a]
2003, 2004	.295[a]
Naugatex 2000, 2001, 2006	.263[a]
2002	.288[a]
2005	.30[a]
Pliolite Latex 2000, 2001	.2775[c]
2076	.29[c]
S-2000	.2275[a]
2006	.215[a]

Cold SBR Latices

Copo 2101, X-765	.30[c]
2102, 2105	.32[c]
FR-S 2105	.31[a]
Naugatex 2101	.285[a]
2105	.312[a]
X-767	.323[a]
Pliolite Latex 2101, X765	.30[c]
2104, 2105	.32[c]
S-2101	.225[a]
-2105	.31[a]

Cold BR Latex§

Pliolite Latex 2104	.32[c]

* Prices are per pound carload or tank-car dry weight unless otherwise specified.
[a] Freight extra.
[b] Minimum freight allowed.
[c] Freight prepaid.

BFG Chem Research Unit

What is called one of the nation's largest centers for synthetic rubber and rubber chemicals development has been completed at the Avon Lake, O., experimental station of B. F. Goodrich Chemical Co., Cleveland, O.

The new $1,500,000 development center will be engaged in the improvement of the company's existing raw material products and the development of new Hycar rubbers and Good-rite chemicals, rubber chemicals, and resins. About 100 people will be employed.

E. W. Harrington has been placed in charge of the new development center, reporting to Anton Vittone, plant manager of the Avon Lake experimental station.

Patience is his middle name

(Dow salesmen take a back seat to prove the value of Vulcosal)

It's true that some molders of rubber products buy our Vulcosal* (Dow Salicylic Acid) without hesitation. Its dust-free quality speaks for itself.

But others who are looking for improved retardation, or are including a retarder for the first time, move cautiously. And rightly so. A switch in process puts money at stake . . . lots of it. So our salesman bides his time. It is not evident though, for his is not idle patience.

While customers are testing, comparing, and verifying results with Vulcosal—other calls on manufacturers keep him circulating, keep him abreast of scorching problems in the vulcanization process. But patience rules . . . and is rewarding.

For, time and time again, testing Vulcosal results in buying Vulcosal—the truly dustless industrial salicylic acid. May we send you a sample and specification data? THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. FC 858P-2.

*Trademark of The Dow Chemical Company

YOU CAN DEPEND ON DOW

Compounding Ingredients*

Abrasives

Pumicestone, powdered	lb.	$0.0363/	$0.065
Rottenstone, domestic	lb.	.03 /	.04
Shelblast	ton	80.00 /	165.00
Walnut Shell Grits	ton	50.00 /	100.00

Accelerators

A-1 (Thiocarbanilide)	ton	.50 /	.57
A-32	ton	.66 /	.80
A-100	lb.	.52 /	.66
Accelerator 49		.57 /	.58
52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	4.25	
89	lb.	1.20	
108	lb.	.91	
552	lb.	2.25	
808	lb.	.66 /	.68
833	lb.	1.17 /	1.19
Altax	lb.	.50 /	.52
Arazate	lb.	2.25	
Beutene	lb.	.66 /	.71
Bismate	lb.	3.00	
B-J-F	lb.	.27 /	.32
Butasan	lb.	1.04	
Butazate	lb.	1.04	
Butyl Accelerator Eight	lb.	1.10 /	1.35
Zimate	lb.	1.04	
Captax	lb.	.40 /	.42
C-P-B	lb.	1.95	
Cumate	lb.	1.45	
Dibs	lb.	.85	
Diesterex N		.50 /	.57
Dipac	lb.	.85	
DOTG (diorthotolylguanidine)			
Cyanamid	lb.	.62 /	.63
Du Pont	lb.	.62 /	.63
DPG (diphenylguanidine)			
Cyanamid	lb.	.52 /	.53
Monsanto	lb.	.52 /	.58
El-Sixty	lb.	.60 /	.67
Ethasan	lb.	1.04	
Ethazate	lb.	1.04	
50-D	lb.	.85	
Ethyl Thiurad	lb.	1.04	
Tuads	lb.	1.04	
Tuex	lb.	1.04	
Zimate	lb.	1.04	
Ethylac #650	lb.	.93 /	.95
Guantal	lb.	.60 /	.67
Hepteen	lb.	.44 /	.50
Base	lb.	1.85	
Ledate	lb.	1.04	
MBT (2-mercaptobenzothiazole)			
American Cyanamid	lb.	.42 /	.44
Du Pont	lb.	.42 /	.44
Naugatuck	lb.	.42 /	.47
-XXX, Cyanamid	lb.	.53 /	.55
MBTS (mercaptobenzothiazyl disulfide)			
Cyanamid	lb.	.52 /	.54
Du Pont	lb.	.52 /	.54
Naugatuck	lb.	.52 /	.57
-W Cyanamid	lb.	.57 /	.59
Metac #225	lb.	.75 /	1.05
Mertax	lb.	.53 /	.60
Methasan	lb.	1.04	
Methazate	lb.	1.04	
Methyl Tuads	lb.	1.14	
Zimate	lb.	1.04	
Monex	lb.	1.14	
Mono-Thiurad	lb.	1.14	
2-MT (2-mercaptothiazoline)			
Du Pont	lb.	1.00	
NOBS No. 1	lb.	.74 /	.76
Special	lb.	.79 /	.81
O-X-A-F	lb.	.53 /	.58
Pentex	lb.	1.14	
Flo-	lb.	.26	
Permalux	lb.	2.17	
Phenex	lb.	.52 /	.59
Pip-Pip		2.07	
R-2 Crystals	lb.	4.35	
Rotax	lb.	.51 /	.53
RZ-50, -50B	lb.	1.00	
S. A. 52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	2.50	
Santocure	lb.	.74 /	.81
NS	lb.	.79 /	.86
Selenacs	lb.	4.25	
SPDX-GH	lb.	.69 /	.74
GL	lb.	1.20 /	1.34
Tellurac	lb.	1.21	
Tepidone	lb.	.45 /	.48
Tetrone A	lb.	1.91	
Thiofide	lb.	.52 /	.59
S	lb.	.62 /	.69
Thionex	lb.	1.14	
Thiotax	lb.	.42 /	.49
Thiurad	lb.	1.14	
Thiuram E	lb.	1.04	
M	lb.	1.14	
Trimene	lb.	.56 /	.62
Base	lb.	1.03 /	1.10
Tuex	lb.	1.14	
Ultex	lb.	1.00 /	1.10
Unads	lb.	1.14	
Ureka Base	lb.	.66 /	.73
Vulcacure NB	lb.	.45	
NS	lb.	.75 /	1.05
ZB, ZE, ZM	lb.	.85 /	.89
Z-B-X	lb.	$2.45	
Zenite	lb.	.52 /	$0.54
A	lb.	.62 /	.64
Special	lb.	.53 /	.55
Zetax	lb.	.51 /	.53
Zimate	lb.	1.04	

Accelerator-Activators, Inorganic

Lime, hydrated	ton	21.96	
Litharge, comml.	lb.	.175 /	.18
Eagle, sublimed	lb.	.18	
National Lead, sublimed	lb.	.18 /	.19
Red lead, comml.	lb.	.185 /	.195
Eagle	lb.	.19	
National Lead	lb.	.19 /	.20
White lead, carbonate	lb.	.19 /	.20
Eagle	lb.	.19 /	.20
National Lead	lb.	.18 /	.19
Silicate	lb.	.1725/	.1825
Eagle	lb.	.20 /	.2175
National Lead	lb.	.1625/	.1725
Zinc oxide comml.†	lb.	.145 /	.1925

Accelerator-Activators, Organic

Aktone	lb.	.2125/	.2325
Barak	lb.	.62	
Capital 170	lb.	.215 /	.255
171	lb.	.1375/	.1775
700, 701	lb.	.1575/	.1975
705, 710	lb.	.1575/	.1975
800	lb.	.1125/	.1325
801	lb.	.1475/	.1675
802	lb.	.1525/	.1725
803	lb.	.175 /	.195
Curade	lb.	.57 /	.59
D-B-A	lb.	1.95	
Emery 600	lb.	.1375/	.1775
Groco 30	lb.	.1375/	.1775
35	lb.	.1425/	.1825
Guantal	lb.	.57 /	.64
Hyfac 400	lb.	.1062/	.1375
430	lb.	.1612/	.1925
431	lb.	.1837/	.215
Hystrene S-97	lb.	.1863/	.2125
T 45	lb.	.1638/	.19
T-70	lb.	.1738/	.20
Industrene B	lb.	.1263/	.1525
R	lb.	.1138/	.14
158	lb.	.1313/	.1575
254	lb.	.1413/	.1675
262	lb.	.1513/	.1775
Laurex	lb.	.33 /	.37
MODX	lb.	.295 /	.345
NA-22	lb.	1.00	
Oleic acid, comml.	lb.	.185 /	.225
Emersol 210 Elaine	lb.	.1575/	.2075
Groco 2, 4, 8, 18	lb.	.1575/	.1975
Plastone	lb.	.27 /	.30
Polyac	lb.	1.85	
Ridacto	lb.	.25 /	.26
Seedine	lb.	.1485/	.1703
Stearex Beads	lb.	.1488/	.1588
Stearic acid			
Emersol 120	lb.	.1463/	.1775
150	lb.	.1787/	.21
Hydrofoil 51	lb.	.09	
Hydrogenated, rubber grd.			
Groco	lb.	.125 /	.145
Rufat 75	lb.	.1062/	.1325
Single pressed, comml.	lb.	.1475/	.1675
Emersol 110	lb.	.1412/	.1725
Groco 53	lb.	.1475/	.1675
Wilmar 253	lb.	.1413/	.1675
Double pressed, comml.	lb.	.1525/	.1725
Groco 54	lb.	.1525/	.1725
Wilmar 254	lb.	.1463/	.1725
Triple pressed, comml.	lb.	.175 /	.195
Groco 55	lb.	.175 /	.195
Wilmar 255	lb.	.1688/	.195
Sterene 60-R	lb.	.09 /	.1075
Tonox	lb.	.515 /	.605
Vimbra	lb.	.32 /	.385
Vulklor	lb.	.88 /	1.08
Wilmar 110	lb.	.1575/	.1975
434	lb.	.1375/	.1775
Zinc stearate, comml.	lb.	.39 /	.44

Antioxidants

AgeRite Alba	lb.	2.35 /	2.45
Gel	lb.	.64 /	.66
H. P.	lb.	.72 /	.74
Hipar	lb.	.98 /	1.00
Powder	lb.	.52 /	.54
Resin	lb.	.75 /	.77
D	lb.	.52 /	.54
Spar	lb.	.52 /	.54
Stalite	lb.	.52 /	.54
S	lb.	.52 /	.54
White	lb.	1.45 /	1.55
Akroflex C	lb.	.81 /	.83
CD	lb.	.76 /	.78
Albasan	lb.	$0.69 /	$0.73
Allied AA-1144	lb.	.23 /	.24
AA-1177	lb.	.155 /	.165
Aminox	lb.	.55 /	.60
Antioxidant 425	lb.	2.47 /	2.50
2246	lb.	1.50 /	1.53
Antisol	lb.	.23 /	.24
Antisun	lb.	.15 /	.51
Antox	lb.	.55 /	.57
Aranox	lb.	3.25 /	.54
Betanox Special	lb.	.85 /	.90
B-L-E, -25	lb.	.55 /	.60
Burgess Antisun Wax	lb.	.185	
B-X-A	lb.	.55 /	.60
Copper Inhibiter X-872-L	lb.	2.01	
D-B-P-C	lb.	.91 /	1.16
Flectol H		.55 /	.62
Flexamine	lb.	.76 /	.81
Heliozone	lb.	.31 /	.32
Ionol	lb.	.91 /	1.65
Microflake	lb.	.20 /	.24
NBC	lb.	1.55	
Neozone A	lb.	.59 /	.61
C	lb.	.83	
D	lb.	.55 /	.57
Nevastain A	lb.	.51 /	.61
B	lb.	.51 /	.70
Octamine	lb.	.55 /	.60
PDA-10	lb.	.46 /	.48
Perflectol	lb.	.61 /	.68
Permalux	lb.	2.17	
Polygard	lb.	.55 /	.60
Polylite	lb.	.55 /	.60
Protector	lb.	.26 /	.31
Rio Resin	lb.	.60 /	.62
Santoflex 35	lb.	.72 /	.79
75	lb.	.97 /	1.04
AW	lb.	.78 /	.85
B	lb.	.52 /	.59
BX	lb.	.63 /	.70
DD	lb.	.55 /	.62
Santovar A	lb.	1.50 /	1.57
Santowhite Crystals, Powder	lb.	1.55 /	1.62
L	lb.	.55 /	.62
MK	lb.	1.25 /	1.32
Stabilite	lb.	.55 /	.59
Alba	lb.	.72 /	.79
L	lb.	.60 /	.64
White	lb.	.52 /	.60
Powder	lb.	.41 /	.47
Styphen I	lb.	.51 /	.55
Sunolite #100	lb.	.21 /	.23
#127	lb.	.17 /	.19
Sunproof-713	lb.	.25 /	.30
Improved	lb.	.25 /	.30
Jr.	lb.	.20 /	.25
Tenamene 3	lb.	.91 /	1.05
Thermoflex	lb.	1.00 /	1.02
Tonox	lb.	.52 /	.57
Tysonite	lb.	.24 /	.2475
Velvapex 51-250	lb.	.40 /	
V-G-B	lb.	.75 /	.80
Wing-Stay S	lb.	.53 /	.65
Zenite	lb.	.52 /	.54

Antiozonants

Tenamene 30, 31	lb.	1.36 /	1.38
UOP 88, 288	lb.	1.25 /	1.29

Antiseptics

Copper naphthenate, 6-8%	lb.	.245	
Pentachlorophenol	lb.	.22 /	.30
Resorcinol, technical	lb.	.775 /	.785
Zinc naphthenate, 8-10%	lb.	.245 /	.30

Blowing Agents

Ammonium bicarbonate	lb.	.07 /	.09
Carbonate	lb.	.16	
Blowing Agent CP 1475	lb.	.32 /	.35
Celogen	lb.	1.95	
50 C	lb.	1.01 /	1.07
Opex	lb.	.75 /	.76
Sodium bicarbonate	100 lbs.	2.55 /	3.85
Carbonate, tech.	100 lbs.	1.35 /	5.52
Sponge Paste	lb.	.20	
Unicel ND	lb.	.76	
NDX	lb.	1.52	
S	lb.	.20	

Bonding Agents

Braze	gal.	6.00 /	9.00
Cover cement	gal.	2.50 /	4.00
Chemlok 201	gal.	5.00 /	6.50
220	gal.	9.75 /	11.50
602	gal.	25.00 /	26.00
603	gal.	36.50 /	37.00
614	gal.	45.00	
Flocking Adhesive RFA17, RFA22, RFA25	lb.	.50	
G-E Silicone Paste SS-15	lb.	4.52 /	5.10
SS-64	lb.	3.65 /	6.75
-67 Primer	lb.	7.50 /	12.50
Gen-Tac Latex	lb.	.70 /	.805
Hylene M	gal.	3.50 /	3.75
M-50	gal.	1.90 /	2.15
Kalabond Adhesive	gal.	6.50 /	16.00
Tie Cement	gal.	2.00 /	5.60
Thixons	gal.	1.48 /	12.00
Ty Ply, BN, Q, S, UP, 3640	gal.	6.75 /	8.00
RC	gal.	3.75 /	5.00

Brake Lining Saturants

BRT 3	lb.	.018 /	.0265
Resinex L-S	lb.	.0225/	.03

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* Prices, in general, are f.o.b. works. Range indicates grade or quantity variations. No guarantee of these prices is made. Spot prices should be obtained from individual suppliers.

† For trade names, see Color—White, Zinc Oxides.

‡ At the request of the suppliers, the lowest prices shown for carbon blacks are for carloads in bags. Prices for hopper carloads are lower.

Carbon Blacks‡

Conductive Channel—CC

Continental R-40	lb.	$0.23 /	$0.30
Kosmos/Dixie BB	lb.	.23 /	.30
Spheron C	lb.	.15 /	.195
Voltex	lb.	.18 /	.315

Easy Processing Channel—EPC

Collocarb EPC	lb.	.059 /	.099
Continental AA	lb.	.074 /	.1225
Kosmobile 77/Dixiedensed 77	lb.	.074 /	.1225
Micronex W-6	lb.	.0775/	.145
Spheron #9	lb.	.0725/	.1225
Texas E	lb.	.074 /	.1225
Witco #12	lb.	.074 /	.1225
Wyex EPC	lb.	.0775/	.135

Hard Processing Channel—HPC

Continental F	lb.	.074 /	.1225
HX HPC	lb.	.074 /	.1225
Kosmobile S/Dixiedensed S	lb.	.074 /	.1225
Micronex Mk. II	lb.	.0775/	.145
Witco #6	lb.	.074 /	.1225

Medium Processing Channel—MPC

Arrow MPC	lb.	.0775/	.135
Continental A	lb.	.074 /	.1225
Kosmobile S-66/Dixiedensed S-66	lb.	.0775/	.145
Micronex Standard	lb.	.0725/	.14
Spheron #6	lb.	.0725/	.1225
Texas 109	lb.	.079 /	.1275
M	lb.	.074 /	.1225
Witco #1	lb.	.074 /	.1225

Conductive Furnace—CF

Aromex CF	lb.	.0875/	.145
Vulcan C	lb.	.105 /	.15
SC	lb.	.18 /	.223

Fast Extruding Furnace—FEF

Arovel FEF	lb.	.0675/	.125
Continex FEF	lb.	.06 /	.10
Kosmos 50/Dixie 50	lb.	.06 /	.10
Statex M	lb.	.0675/	.125
Sterling SO	lb.	.0625/	.10

Fine Furnace—FF

Statex B	lb.	.0725/	.13
Sterling 99	lb.	.0675/	.105

High Abrasion Furnace—HAF

Aromex HAF	lb.	.0775/	.135
Continex HAF	lb.	.079 /	.125
Kosmos 60/Dixie 60	lb.	.079 /	.1175
Philblack O	lb.	.0775/	.125
Statex R	lb.	.0775/	.135
Vulcan #3	lb.	.0725/	.114

Intermediate Super Abrasion Furnace—ISAF

Aromex ISAF	lb.	.0925/	.15
Kosmos 70/Dixie 70	lb.	.10 /	.145
Philblack I	lb.	.0925/	.14
Statex 125	lb.	.0925/	.15
Vulcan 6	lb.	.0875/	.13

Medium Abrasion Furnace—MAF

Philblack A	lb.	.0675/	.115

Super Abrasion Furnace—SAF

Philblack E	lb.	.115 /	.1625
Vulcan 9	lb.	.115 /	.165

General Purpose Furnace—GPF

Arogen GPF	lb.	.06 /	.1175
Sterling V	lb.	.055 /	.09
V Non-staining	lb.	.05 /	.09

High Modulus Furnace—HMF

Collocarb HMF	lb.	.045 /	.085
Continex HMF	lb.	.055 /	.095
Kosmos 40/Dixie 40	lb.	.055 /	.095
Modulex HMF	lb.	.0625/	.12
Statex 93	lb.	0625/	.12
930	lb.	.047 /	.087
Sterling L, LL	lb.	.0575/	.095

Semi-Reinforcing Furnace—SRF

Collocarb SRF	lb.	.042 /	.082
Continex SRF	lb.	.045 /	.085
Essex SRF	lb.	.0575/	.115
Furnex	lb.	.0575/	.115
Gastex	lb.	.0575/	.0925
Kosmos 20/Dixie 20	lb.	.045 /	.085
Pelletex, NS	lb.	.0525/	.0875
Sterling NS, S	lb.	.0475/	.0875
R	lb.	.0575/	.0925

Fine Thermal—FT

P-33	lb.	.0575	
Sterling FT	lb.	.0575	

Medium Thermal—MT

Sterling MT	lb.	.04	
Non-staining	lb.	.05	
Thermax	lb.	$0.04	
Stainless	lb.	.05	

Colors

Black

Iron oxides, commil	lb.	.1235/	$0.135
BK—Lansco	lb.	.1275/	13
Williams	lb.	.145	
Lansco synthetic	lb.	.10	
Mapico	lb.	.1475/	.15
Lampblack, commil	lb.	.16 /	.45
Superjet	lb.	.085 /	.12
Permanent Blue	lb.	.80 /	1.05
Stan-Tone	lb.	.45 /	1.20
Vansul masterbatch	lb.	.60 /	.65
Paste	lb.	.14 /	.15

Blue

Alkali Blue	lb.	1.12 /	2.10
Cyanamid ultramarine	lb.	.29	
Du Pont	lb.	1.77 /	4.55
Filo	lb.	.28	
Heveatex pastes	lb.	.80 /	1.45
Lansco ultramarines	lb.	.25 /	.28
Monsanto Blue 7	lb.	1.55	
11	lb.	3.45	
DPB-283	lb.	1.93	
S-11	lb.	2.05	
Permanent Blue	lb.	.80 /	1.05
Stan-Tone	lb.	1.55 /	1.60
Vansul masterbatch	lb.	.90 /	2.70

Brown

Filo	lb.	.13	
Iron oxides, commil	lb.	.1425/	.145
Lansco synthetic	lb.	.125	
Mapico Brown	lb.	.1575/	.16
Sienna, burnt, commil	lb.	.0425/	.155
Williams	lb.	.115 /	.1775
Raw, commil	lb.	.045 /	.1325
Williams	lb.	.08 /	.1725
Umber, burnt, commil	lb.	.06 /	.07
Williams	lb.	.0725/	.085
Raw, commil	lb.	.0625/	.07
Williams	lb.	.07 /	.0825
Williams, pure brown	lb.	.155	
Vandyke	lb.	.12	
Mapico Tan	lb.	.2325/	.235
Metallic Brown	lb.	.05 /	.06
Vansul masterbatch	lb.	2.10 /	2.20

Green

Chrome	lb.	.19 /	.50
Green	lb.	.80 /	2.40
Oxide	lb.	.3925/	1.10
Cyanamid	lb.	1.10	
G-4099, -6099	lb.	.4525	
GH-9869	lb.	1.10 /	1.25
9976	lb.	1.20 /	1.35
Du Pont	lb.	1.97 /	2.80
Filo	lb.	.40	
Heveatex pastes	lb.	.95 /	1.85
Lansco Toner	lb.	1.35	
Monsanto Green 3	lb.	2.75	
14	lb.	1.45	
17	lb.	3.95	
71205	lb.	1.35	
DGP	lb.	2.03	
S-17	lb.	2.25	
Stan-Tone	lb.	1.75 /	4.60
Vansul masterbatch	lb.	2.00 /	2.60

Orange

Cyanamid Permatons	lb.	1.35	
Du Pont	lb.	2.75	
Monsanto Orange 68187	lb.	2.90	
Stan-Tone	lb.	.70 /	5.05
Vansul masterbatch	lb.	2.00 /	2.60

Red

Antimony trisulfide	lb.	.285 /	.315
R. M. P. No. 3	lb.	.72	
Sulfur Free	lb.	.78	
Brilliant Toning Red	lb.	1.95	
Cadmium red lithopones	lb.	2.21 /	3.77
Cadmolith	lb.	1.72 /	2.20
Cyanamid	lb.	.80 /	1.60
Du Pont	lb.	1.47 /	1.90
Filo	lb.	.11	
Indian Red	lb.	.1275	
Iron oxide, commil	lb.	.06 /	.13
Lansco synthetic	lb.	.1175	
Mapico	lb.	.1425/	.145
Recco	lb.	.12	
Williams Red	lb.	.13 /	.1525
Monsanto Maroon 113	lb.	1.50	
61148	lb.	1.75	
Red 7	lb.	1.55	
41	lb.	4.40	
3501	lb.	1.15	
4004	lb.	1.50	
69191	lb.	3.38	
Autumn	lb.	1.10	
PRP-285	lb.	1.27	
S-44	lb.	1.28	
Rub-Er-Red	lb.	.0975	
Stan-Tone	lb.	.85 /	6.15
Vansul masterbatch	lb.	.95 /	3.30
Venetian	lb.	.04 /	.0675

White

Antimony oxide	lb.	.27 /	.285
Burgess Iceberg	ton	50.00 /	80.00
Cryptone BT	lb.	.10 /	.11
Permolith lithopone	lb.	$0.08 /	$0.0875
Titanium pigments			
Horse Head Anatase	lb.	.255 /	.27
Rutile	lb.	.275 /	.29
Ravox LW	lb.	.195 /	.205
R-110	lb.	.215 /	.225
Ti-Cal	lb.	.075 /	.0825
Ti-Pure	lb.	.195 /	.225
Titanox A, AA, A-168	lb.	.21 /	.22
C-50	lb.	.1225/	.1275
RA, -10, -50	lb.	.23 /	.24
RC	lb.	.0825/	.0875
-HT, -HTX	lb.	.08 /	.085
Unitane	lb.	.255 /	.285
Zopaque Anatase	lb.	.245 /	.27
Rutile	lb.	.205 /	.29
Zinc oxide, commil	lb.	.145 /	.1825
Azo ZZZ-11, -44, -55	lb.	.145 /	.165
20% leaded	lb.	.1505/	.1705
35% leaded	lb.	.155 /	.175
50% leaded	lb.	.1588/	.1788
Eagle AAA, lead free	lb.	.145 /	.155
5% leaded	lb.	.145 /	.155
35% leaded	lb.	.155 /	.165
50% leaded	lb.	.159 /	.169
Florence Green Seal	lb.	.1625/	.1725
Red Seal	lb.	.1575/	.1675
White Seal	lb.	.1675/	.1775
Horsehead XX-4, -78	lb.	.145 /	.155
Kadox-15, -17, -72, -515	lb.	.145 /	.155
-25	lb.	.1675/	.1775
Lehigh, 35% leaded	lb.	.155 /	.175
50% leaded	lb.	.1588/	.1788
Protox-166, -167	lb.	.145 /	.165
St. Joe, lead free	lb.	.122 /	.152
Zinc sulfide, commil	lb.	.253 /	.263
Cryptone ZS	lb.	.253 /	.273

Yellow

Cadmium yellow lithopones	lb.	1.12 /	1.15
Cadmolith	lb.	1.12 /	1.20
Cyanamid Hansa Yellow	lb.	2.10	
Du Pont	lb.	1.80 /	2.25
Filo	lb.	.10	
Iron oxide, commil	lb.	.0525/	.1175
Lansco synthetic	lb.	.1075	
Mapico	lb.	.12 /	.1275
Williams	lb.	.115 /	.1225
Monsanto Yellow 14	lb.	1.91	
10010	lb.	1.91	
BVP-282	lb.	1.21	
GA	lb.	2.45	
S-10010	lb.	1.17	
Stan-Tone	lb.	1.00 /	1.55
Vansul masterbatch	lb.	.95 /	1.95
Williams Ocher	lb.	.0575/	.06

Dusting Agents

Diatomaceous silica	ton	32.00 /	48.00
Extrud-o-Lube, conc	gal.	1.33 /	1.69
Glycerized Liquid Lubricant, concentrated	gal.	1.25 /	1.63
Latex-Lube GR	lb.	.20	
Pigmented	lb.	.1825	
R-66	lb.	.165	
Liqui-Lube	lb.	.1625	
N. T.	lb.	.1675	
Liquizinc No. 305	lb.	.30 /	.35
Lubrex	lb.	.25 /	.30
Mica Concord	lb.	.075 /	.0825
Mineralite	ton	45.00	
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Talc, commil	ton	18.40 /	38.50
EM	ton	11.00 /	63.00
LS Silver	ton	29.25	
Nytals	ton	25.00 /	36.00
Sierra Sagger 7	ton	34.00	
White IR	ton	19.75	
III	ton	20.75	
Vanfre	gal.	2.00	

Extenders

BRS 700	lb.	.02 /	.0285
BRT 7	lb.	.03 /	.031
Cumar Resins	lb.	.065 /	.17
Dielex B	lb.	.06	
Factice, Amberex	lb.	.29 /	.36
Brown	lb.	.1425/	.263
Neophax	lb.	.157 /	.268
White	lb.	.144 /	.285
G. B. Asphaltenes	lb.	.097 /	.177
Millex, W	lb.	.07	
Mineral Rubbers			
Black Diamond	ton	38.00 /	40.00
Hard Hydrocarbon	ton	46.50 /	48.50
Hydrocarbon MR	ton	48.00 /	55.00
Parmr	ton	21.00 /	29.00
T-MR Granulated	ton	47.50 /	50.00
Nuba No. 1, 2	lb.	.0575/	.0625
3X	lb.	.0775/	.0825
OPD-101	lb.	.26	
Rubber substitute, brown	lb.	.16 /	.2572
Car-Bel-Ex A	lb.	.14	
Car-Bel-Lite	lb.	.35	
Extender 600	lb.	.1765	
White	lb.	.192 /	.2103
Stan-Shells	ton	35.00 /	73.00
Sublac Resin PX-5	lb.	.215 /	.235
Sundex 53	gal.	.12	
85	gal.	.1725	
Synthetic 100	lb.	.41	
Vistanex	lb.	.35 /	.475

Fillers, Inert

Agrashell flour	ton	50.00 /	74.00
Albacar	ton	55.00 /	75.00

Barytes, floated, white	ton	$49.00	/ $70.85
Off-color, domestic	ton	25.00	
No. 1	ton	55.00	/ 77.50
2	ton	50.00	/ 72.50
Sparmite	ton	95.00	/ 117.00
Blanc fixe	ton	100.00	/ 165.00
Burgess Iceberg	ton	50.00	/ 80.00
Pigment #20	ton	35.00	/ 60.00
#30	ton	37.00	/ 60.00
HC-75	ton	12.00	/ 30.00
-80	ton	14.00	/ 32.00
WP #1	ton	11.00	/ 16.00
Cary #200	ton	30.00	/ 55.00
Citrus seed meal	lb.	.04	
Oil	lb.	.15	
Clays			
A. F. D. Filler	ton	26.50	/ 100.00
Aiken	ton	14.00	
Albacar	ton	50.00	/ 55.00
Aluminum Flake	ton	22.25	/ 60.00
#5	ton	24.50	/ 30.00
Champion	ton	14.50	
Crown	ton	14.00	/ 33.00
Dixie	ton	14.00	
Franklin	ton	13.50	/ 35.25
GK Soft Clay	ton	11.00	
Harwick	ton	15.50	/ 55.50
Hi-White R	ton	13.50	
Hydratex R	ton	28.00	
Kaolloid	ton	10.50	
Natka 1200	ton	13.00	
Paragon	ton	13.50	/ 31.50
McNamee	ton	13.50	
RX-43	ton	33.00	
Recco	ton	14.00	
Sno-Brite	ton	12.50	
Stan-Clay	ton	28.00	
Stellar-R	ton	50.00	
Suprex	ton	14.00	/ 32.00
Swanee	ton	12.50	
Windsor	ton	14.00	/ 30.00
DC Silica	lb.	1.45	/ 1.65
Diatomaceous silica	ton	32.00	/ 48.00
Flocks			
Cotton, dark	lb.	.095	/ .135
Dyed	lb.	.55	/ .60
White	lb.	.13	/ .33
Fabrifil X-24-G	lb.	.135	
X-24-W	lb.	.235	
Filfloc 6000	lb.	.33	
F-40-900	lb.	.135	
HSC #35 Silicone Emulsion	lb.	1.22	/ 2.46
Kalite	ton	50.00	/ 65.00
Lithopone, comml.	lb.	.075	/ .085
Astrolith	lb.	.068	/ .0675
Eagle	lb.	.0725	/ .075
Permolith	lb.	.08	/ .0875
Sunolith	lb.	.075	/ .0825
Mica Concord	lb.	.075	/ .0825
Millical	ton	38.00	/ 53.00
Mineralite	ton	40.00	/ 60.00
Non-Fer-Al	ton	32.50	/ 47.50
Purecal	ton	56.75	/ 71.75
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Sawdust	ton	14.00	/ 35.00
Silversheen Mica	lb.	.08	/ .09
StanWhite	ton	10.50	/ 13.10
Super-White Silica	ton	25.00	/ 46.50
Surfex	ton	37.50	/ 52.50
MM	ton	39.50	/ 54.50
Suspenso	ton	35.50	/ 50.50
Ti-Cal	lb.	.0675	
Valron Estersil	lb.	2.00	/ 2.25
Walnut shell flours	ton	50.00	/ 84.00
Whiting, limestone			
Atomite	ton	30.00	
Calcite	ton	23.00	
Calwhite	ton	20.00	
-T	ton	23.00	
Gamaco	ton	32.50	
Keystone	ton	16.00	
Laminar	ton	30.00	
No. 10 White	ton	11.00	
Omya	ton	30.00	
Paxinosa	ton	11.00	/ 19.00
Snowflake	ton	17.00	/ 18.00
Stonelite	ton	9.00	
Witco	ton	8.50	
York	ton	9.50	

Finishes

Apex Bright Finish #5200-E	lb.	.25	
Rubber Finish	gal.	2.50	
Black-out	gal.	4.50	/ 8.00
Flocks, Rayon, colored	lb.	.90	/ 1.50
White	lb.	.75	/ 1.25
Also see Flocks, under Fillers, Inert			
Rubber lacquer, clear	gal.	1.00	/ 2.00
Shellacs, Angelo	lb.	.485	/ .7325
Vac Dry	lb.	.485	/ .57
Talc (*See Talc, under Dusting Agents*)			
Unidip	lb.	.15	/ .20
Wax, Bees	lb.	.68	/ .83
Carnauba	lb.	.57	/ 1.13
Monten	lb.	.27	
No. 118, colors	gal.	.86	/ 1.41
Neutral	gal.	.76	/ 1.31
Van Wax	gal.	1.45	/ 1.50

Latex Compounding Ingredients

Acintol D, DLR	lb.	.06	/ .075
FA #1	lb.	.065	/ .08
#2	lb.	.075	/ .09
Accelerator 552	lb.	$2.25	
J-117, -302	lb.	1.00	/ $1.15
-144	lb.	.15	/ .30
-307	lb.	1.10	/ 1.25
-311	lb.	.60	/ .75
Aerosol, dry types	lb.	.39	/ 1.20
Liquid types	lb.	.40	/ .72
Alcogum AA-16, MA-16	lb.	.20	/ .24
AK-12, PA-10	lb.	.12	/ .14
AN-6	lb.	.05	/ .075
-10	lb.	.085	/ .10
Alrosol	lb.	.41	
Amberex solutions	lb.	.1675	/ .18
Antifoam J-114	lb.	3.25	/ 3.45
P-242	lb.	.24	/ .35
Antioxidant J-137, -140	lb.	.55	/ .70
-139, -293	lb.	1.45	/ 1.60
-182	lb.	2.00	/ 2.15
-186	lb.	1.40	/ 1.55
2246	lb.	1.50	/ 1.53
Anti Webbing Agent J-183	lb.	.75	/ .90
-297	lb.	.27	/ .40
Aquablak B	lb.	.0975	/ .1025
G	lb.	.12	/ .125
K	lb.	.12	/ .125
M	lb.	.105	/ .11
Aquarex D	lb.	.78	
G	lb.	.21	
L	lb.	.94	
MDL	lb.	.33	
ME	lb.	.80	
Aquarex NS	lb.	.60	
SMO	lb.	.50	
WAQ	lb.	.22	
Areskap 50	lb.	.30	/ .38
100, dry	lb.	.60	/ .72
Aresket 240	lb.	.30	/ .38
300, dry	lb.	.60	/ .72
Aresklene 375	lb.	.42	/ .57
Ben-A-Gels	lb.	.98	/ 1.40
Bentone 18, 18C	lb.	.45	
34	lb.	.60	
Casein	lb.	.22	
Cellosize WP-09, -3, -40			
-300	lb.	1.00	/ 1.17
CW-12		.85	
-37	lb.	.70	
DC Antifoam A Compound	lb.	5.45	/ 6.65
Emulsion	lb.	2.05	/ 4.00
AF Emulsion	lb.	2.05	/ 2.85
Compound 7	lb.	5.13	/ 6.50
Defoama W-1701	lb.	.125	
Defoamer 115a	lb.	.50	
Dispersing Agents			
Blancol	lb.	.1525	/ .26
N	lb.	.155	/ .26
Darvan Nos. 1, 2, 3	lb.	.22	/ .30
Daxad 11, 21, 23, 27	lb.	.08	/ .30
Dispersaid H7A	lb.	.58	
1159	lb.	.43	
Emulphor ON-870	lb.	.50	/ .70
Igepal CO-630	lb.	.2875	/ .47
Igepon T-73	lb.	.285	/ .495
T-77	lb.	.45	/ .69
Indulins	lb.	.06	/ .08
Kreelons	lb.	.132	/ .155
Laurelton Oil	lb.	.18	
Leonil SA	lb.	.52	/ .65
Lomar PW	lb.	.18	
Marasperse CB	lb.	.1225	/ .1425
N	lb.	.095	/ .105
Modicols	lb.	.17	/ .58
Nekal BA-75	lb.	.395	/ .54
BX-76	lb.	.63	/ .75
Orzan A	lb.	.0325	
S	lb.	.0425	
Pluronics	lb.	.335	/ .40
Polyfons	lb.	.08	/ .09
Sorapon SF-78	lb.	.28	/ .40
Tergitol NPX	lb.	.275	/ .3074
TMN	lb.	.2875	/ .32
7	lb.	.4125	/ .44
Trenamine W-30	lb.	.15	
W-40	lb.	.60	/ .75
Triton R-100	lb.	.12	/ .25
X-100, -102, -114	lb.	.355	/ .36
Dispersions			
Agehest 1293-22	lb.	1.90	/ 2.00
AgeRite Alba	lb.	3.00	
Powder, Resin D	lb.	.80	
White	lb.	1.80	
Altax	lb.	.75	
Shield Nos. 2, 6	lb.	.08	
3	lb.	.095	
4-35	lb.	.09	
5	lb.	.093	
7-F, 8	lb.	.165	
55	lb.	.18	
Iron Oxide, 60°C	lb.	.40	
L.S.W.	lb.	1.50	
No. 305 Liquizinc	lb.	.30	/ .35
P-33	lb.	.35	
Rotax	lb.	.75	
Sulfur	lb.	.12	/ .30
No. 2	lb.	.14	/ .16
Telloy	lb.	3.00	
Tuads, Methyl	lb.	1.60	
Vulcacure NB	lb.	.45	
NS	lb.	.75	/ 1.05
ZB, ZE, ZM	lb.	.85	/ .89
Vulcanizing, C group	lb.	.40	/ 1.30
G group	lb.	.45	/ .90
N group	lb.	.40	/ 1.00
Vulcafoams	lb.	.40	/ .70
Vulcanols	lb.	.75	/ .80
Zetax	lb.	.75	
Zimates, Butyl	lb.	1.30	
Ethyl, Methyl	lb.	1.35	
Zinc oxide	lb.	.40	
Emulsions			
AgeRite Stalite	lb.	$0.75	
Borden Arcco A-25,			
A-26, 716-30	lb.	.18	/ $0.19
555-40-R	lb.	.185	/ .205
620-32B	lb.	.20	/ .21
716-35	lb.	.17	/ .18
1041-21	lb.	.165	/ .175
Habuco Resin Nos. 502,			
515, 523	lb.	.195	/ .20
503	lb.	.22	/ .225
504, 526	lb.	.19	/ .195
517	lb.	.175	/ .18
524	lb.	.155	/ .16
Resin A-2	lb.	.16	/ .25
P-370	lb.	.175	/ .25
X-210	lb.	.12	/ .22
Freeze-Stabilizer 322	lb.	.40	
12116C	lb.	.52	
Igepon T-43	lb.	.145	/ .35
T-51	lb.	.125	/ .285
-73	lb.	.285	/ .495
Ludox	lb.	.1675	/ .195
Marmix	lb.	.41	/ .48
Merac	lb.	.75	/ 1.05
Micronex, colloidal	lb.	.06	/ .072
Monsanto Blue 4685 WD	lb.	1.60	
Green 4884 WD	lb.	1.80	
Red 127	lb.	1.25	
OPD 101	lb.	.16	/ .26
Picco Latex Plasticizer A-12	lb.	.069	/ .096
Pliolite Latex 150, 190	lb.	.32	/ .41
170	lb.	.37	/ .46
Polyvinyl methyl ether	lb.	.25	/ .45
Resin V	lb.	.13	
Roelgel 100C	lb.	.46	
Santomerse D	lb.	.44	/ .65
S	lb.	.13	/ .25
Sellogen Gel	lb.	.1275	
Sequestrene AA	lb.	.905	/ .975
30A	lb.	.245	/ .265
ST	lb.	.585	/ .615
Setsit #5	lb.	.75	/ 1.05
Stablex A	lb.	.80	/ 1.10
B, G	lb.	.50	/ .95
K	lb.	.27	/ .35
Stablex P	lb.	.35	/ .50
T	lb.	.14	/ .22
Surfactol 13	lb.	.345	/ .36
Webnix	lb.	1.50	/ 2.50

Mold Lubricants

Acintol D	lb.	.06	/ .075
A-C Polyethylene	lb.	.30	/ .37
Alipal CO-433	lb.	.25	/ .45
CO-436	lb.	.22	/ .41
Aquarex Compounds	lb.	.21	/ .94
Carbowax 200, 300, 400	lb.	.22	/ .25
1500	lb.	.255	/ .2825
4000	lb.	.31	/ .32
6000	lb.	.35	/ .36
Castorwax	lb.	.3375	/ .3575
Colite Concentrate	gal.	.90	/ 1.15
D-Tak Dip #10	gal.	1.50	
DC Mold Release Fluid	lb.	3.14	/ 4.75
Compound 4, 7	lb.	5.13	/ 6.50
Emulsion 7	lb.	1.59	/ 2.07
8, 35, 35A, 35B, 36	lb.	1.26	/ 1.80
200 Fluid	lb.	3.14	/ 4.75
ELA	lb.	.82	
FT Wax 200	lb.	.265	/ .42
300	lb.	.295	/ .45
Glycerized Liquid Lubricant, concentrated	gal.	1.25	/ 1.63
Igepals	lb.	.2875	/ .74
Igepon AP-78	lb.	.44	/ .68
T-43	lb.	.145	/ .35
-51	lb.	.125	/ .285
-73	lb.	.285	/ .495
Lubrex	lb.	.27	/ .32
Lubri-Flo	gal.	10.00	/ 12.05
Lustermold	lb.	.41	
L-41 Diethyl Silicone Oil	lb.	3.50	
Mold Paste	lb.	.25	
Monopole Oil	lb.	.16	
Monten Wax	lb.	.57	
Para Lube	lb.	.046	/ .048
Plaskon 8406, 8407	lb.	.30	/ .37
8416, 8417	lb.	.35	/ .42
8429	lb.	.40	/ .47
Pluronics	lb.	.335	/ .44
Poly-Brite PE-200	lb.	.28	/ .42
600	lb.	.42	/ .58
Poly-Cone 125X	lb.	1.22	/ 1.40
1000	lb.	.94	/ 1.06
Polyglycol E series	lb.	.29	/ .42
RA-1, -2, -3	gal.	2.25	/ 3.00
Rubber Glo	gal.	.94	/ .97
SM-33, -55, -61, -62	lb.	1.22	/ 1.76
Soap, Hawkeye	lb.	1.35	/ 1.45
Purity	lb.	.155	/ .165
Sodium stearate	lb.	.40	
Stoner's 700 series	gal.	1.20	/ 1.25
800 series	gal.	1.26	/ 1.70
900 series	gal.	1.55	/ 2.55
A Series	gal.	1.80	/ 4.50
Ucon 50-HB Series	lb.	.25	/ .375
Ulco	lb.	.12	/ .23
Vanfre	gal.	2.50	/ 3.00

Odorants

Alamasks	lb.	.75	/ 6.50
Coumarin	lb.	2.95	/ 3.55
Curodex 19	lb.	4.75	/ 5.05
188	lb.	5.75	
198	lb.	5.75	
Ethavan	lb.	6.75	/ 7.35

Latex Perfume #7	lb.	$04.00
Neutroleum Gamma	lb.	3.60
Rubber Perfume #10	lb.	2.60
Vanillin, Monsanto	lb.	3.00 /

Plasticizers and Softeners

Acintol R	lb.	.065 / .07
Adipol 2EH, 10A	lb.	.40 / .435
BCA	lb.	.43 / .455
ODY	lb.	.45 / .485
Admex 710	lb.	.325
711	lb.	.345
744	lb.	.40
Aro Lene #1980	lb.	.10 / .12
Baker AA Oil	lb.	.195 / .24
Crystal O Oil	lb.	.21 / .255
Processed oils	lb.	.215 / .235
Bardol, 639	lb.	.215 / .235
B	lb.	.0625/ .065
Benzoflex 2-45	lb.	.26 / .29
9-88	lb.	.27 / .30
Bondogen	lb.	.55 / .60
BRC 20	lb.	.15 / .175
22	lb.	.025 / .0275
30	lb.	.0125/ .021
521	lb.	.019 / .02
BRH 2	lb.	.0213/ .0351
BRS 700	lb.	.02 / .0285
BRT 7	lb.	.03 / .031
BRV	lb.	.0475/ .0565
Bunarex Liquid	lb.	.0425/ .0555
Resins	lb.	.065 / .1225
Bunnatol G, S	lb.	.40 / .505
Butac	lb.	.125 / .135
Butyl stearate, comml.	lb.	.255
Binney & Smith	lb.	.23 / .26
Hardesty	lb.	.23 / .26
Ohio-Apex	lb.	.22 / .255
Cabflex HS-10	lb.	.44 / .47
G. P.	lb.	.0125/ .02
R-100	lb.	.045 / .0525
TT	lb.	.017 / .0245
Califlux G. P.	lb.	.015 / .0225
R-100	lb.	.0475/ .0575
T-T	lb.	.019 / .0295
510, 550	lb.	.0275/ .0375
Capryl alcohol, comml.	lb.	.195 / .235
Binney & Smith	lb.	.18 / .28
Hardesty	lb.	.18 / .28
Chlorowax 40	lb.	.1625/ .1825
70	lb.	.185 / .245
-S	lb.	.21 / .27
Circo light	gal.	.17
Circosol-2XH	gal.	.185
Contogums	lb.	.0875 / .111
Cumar Resins	lb.	.065 / .17
DBM (dibutyl-m-cresol)		
Darax	lb.	.32 / .3475
DBP (dibutyl phthalate), comml.	lb.	.30 / .33
Darex	lb.	.30 / .33
Eastman	lb.	.30 / .33
Hatco	lb.	.30 / .33
Monsanto	lb.	.30 / .33
Naugatuck	lb.	.30 / .33
Ohio-Apex	lb.	.30 / .335
PX-104	lb.	.30 / .33
Rubber Corp. of America	lb.	.30 / .44
Sherwin-Williams	lb.	.30 / .33
DBS (dibutylsebacate) comml.	lb.	.66 / .69
Hatco	lb.	.66 / .685
Monoplex	lb.	.66 / .675
Naugatuck	lb.	.665 / .69
PX-404	lb.	.665 / .69
DCP (dicaprylphthalate), comml.	lb.	.295 / .325
Hatco	lb.	.295 / .325
Monoplex	lb.	.30 / .315
DDA (didecyladipate)		
Cabflex	lb.	.425 / .455
Good-rite GP-236	lb.	.40 / .55
DDP (didecylphthalate)		
Cabflex	lb.	.305 / .335
Good-rite GP-266	lb.	.295 / .45
Hatco	lb.	.305 / .435
Defoamer X-3	lb.	.355
DIBA (diisobutyladipate)		
Cabflex	lb.	.4325 / .4625
Darex	lb.	.4325 / .4625
Eastman	lb.	.41 / .44
Ohio-Apex	lb.	.41 / .445
DIDA (diisodecyladipate)		
Monsanto	lb.	.425 / .455
DIDP (diisodecylphthalate)		
Darex	lb.	.32 / .35
Monsanto	lb.	.305 / .335
Ohio-Apex	lb.	.295 / .33
PX-120	lb.	.305 / .335
Dielex B	lb.	.06
Diethylene glycol, comml.	lb.	.1525/ .1825
Wyandotte	lb.	.15 / .165
Dinopol IDO	lb.	.29 / .325
DIOA (diisooctyladipate)		
Cabflex	lb.	.425 / .455
Naugatuck	lb.	.435 / .465
PX-208	lb.	.425 / .455
Rubber Corp. of America	lb.	.425 / .56
DIOP (diisooctylphthalate), comml.	lb.	.305 / .335
Cabflex	lb.	.305 / .335
Darex	lb.	.32 / .35
Eastman	lb.	.305 / .335
Hatco	lb.	.305 / .335
Monsanto	lb.	.305 / .335
Naugatuck	lb.	.305 / .335
Ohio-Apex	lb.	.285 / .32
PX-108	lb.	.305 / .335
Rubber Corp. of America	lb.	.305 / .45
Sherwin-Williams	lb.	.32 / .34
DIOS (diisooctylsebacate), comml.	lb.	$0.61 / $0.64
Rubber Corp. of America	lb.	.61 / .84
DIOZ (diisooctylazelate)		
Cabflex	lb.	.48 / .51
Dipolymer Oil	gal.	.33 / .38
Dispersing Oil No. 10	lb.	.06 / .0625
DNODP (di-n-octyl-n-decyl phthalate), Monsanto	lb.	.345 / .375
DOA (dioctyladipate), comml.	lb.	.425 / .455
Cabflex	lb.	.425 / .455
Eastman	lb.	.40 / .43
Good-rite GP-233	lb.	.40 / .55
Hatco	lb.	.435 / .465
Monsanto	lb.	.425 / .455
Naugatuck	lb.	.435 / .465
PX-238	lb.	.425 / .455
Rubber Corp. of America	lb.	.425 / .56
DOP (dioctylphthalate), comml.	lb.	.305 / .335
Cabflex	lb.	.305 / .335
Darex	lb.	.32 / .35
Eastman	lb.	.305 / .335
Good-rite GP-261	lb.	.285 / .44
Hatco	lb.	.305 / .335
Monsanto	lb.	.305 / .335
Naugatuck	lb.	.305 / .335
Ohio-Apex	lb.	.285 / .32
Polycizer 162	lb.	.28 / .435
PX-138	lb.	.305 / .335
Rubber Corp. of America	lb.	.305 / .45
Sherwin-Williams	lb.	.305 / .335
DOS (dioctylsebacate), comml.	lb.	.61 / .64
Eastman	lb.	.61 / .64
Hatco	lb.	.61 / .635
Monoplex	lb.	.61 / .635
Naugatuck	lb.	.615 / .64
PX-438	lb.	.615 / .64
Rubber Corp. of America	lb.	.61 / .84
Drapex 3.2	lb.	.40 / .54
Dutch Boy NL-A10 (DBP)	lb.	.30 / .33
-A20 (DOP), A30 (DIOP)	lb.	.305 / .335
-A54	lb.	.295 / .325
-C20 (DOS)	lb.	.61 / .63
-F21	lb.	.395 / .425
-F31	lb.	.44 / .47
-F41	lb.	.48 / .51
Dutrex 6	lb.	.025 / .035
Dymerex Resin	lb.	.135 / .1475
Emulphor EL-719	lb.	.52 / .73
Endor	lb.	.65
Ethox	lb.	.43 / .455
Ethylene glycol, comml.	lb.	.135 / .165
Wyandotte	lb.	.1325/ .1425
Flexol 3 GH	lb.	.44 / .46
3 GO	lb.	.53 / .55
4 GO	lb.	.325 / .355
10-A	lb.	.425 / .455
426	lb.	.27 / .30
810, 810X, 10-10, 10-10X	lb.	.305 / .335
TOF, A-26	lb.	.435 / .465
Flexricin P-4	lb.	.3475/ .3625
P-6	lb.	.415 / .43
P-8	lb.	.3475/ .3625
PG-16	lb.	.335 / .35
Fortex	lb.	.125 / .145
G. B. Asphaltic Flux	gal.	.097 / .177
Naphthenic Neutrals	gal.	.125 / .215
Process oil, light	lb.	.0275/ .0375
Medium	lb.	.0375/ .0475
Galex W-100	lb.	.155 / .18
W-100 D	lb.	.1525/ .1775
Gilsowax B	lb.	.0975/ .11
Harchemex	lb.	.25 / .34
Harflex	lb.	1.25 / 1.335
40	lb.	.64 / .725
50, 80, 300	lb.	.58 / .665
60	lb.	.62 / .705
90	lb.	.88 / .965
120, 150	lb.	.305 / .395
140, 160	lb.	.30 / .33
180	lb.	.295 / .38
220, 250	lb.	.425 / .515
260	lb.	.42 / .45
280	lb.	.42 / .51
500	lb.	.315 / .41
HB-20	lb.	.15 / .17
-40	lb.	.19 / .21
Heavy Resin Oil	lb.	.0225/ .0375
HSC-13	lb.	.25 / .32
-39	lb.	.22 / .29
Hycar 1312	lb.	.60
Indonex	gal.	.11 / .19
Kapsol	lb.	.33 / .355
Kenflex A, L	lb.	.26 / .27
B	lb.	.23 / .24
N	lb.	.18 / .19
Kessoflex 103	lb.	.405
105	lb.	.3325
106	lb.	.38
107	lb.	.525
110	lb.	.24
111	lb.	.28
KP-23	lb.	.29 / .325
-90	lb.	.40 / .435
-140	lb.	.46 / .485
-201	lb.	.58 / .59
-220	lb.	.32 / .355
-555	lb.	.565 / .57
Kronisol	lb.	.33 / .365
Kronitex AA, I, K-3, Mx	lb.	.325 / .36
LX-685, -125, -135	lb.	.125 / .135
Marvinol plasticizers	lb.	.28 / .8825
Methox	lb.	.385 / .41
Monoplex S-38	lb.	.215 / .24
S-71	lb.	.45 / .475
Morflex	lb.	.25 / .65
Natac	lb.	$0.12 / $0.13
Neoprene Peptizer P-12	lb.	1.05
Nevillac	lb.	.31 / .85
Neville R Resins	lb.	.145 / .205
Nevinol	lb.	.24
No. 1-D heavy oil	lb.	.065
ODA (octyldecyladipate) Cabflex	lb.	.425 / .455
Good-rite GP-235	lb.	.40 / .55
ODP (octyldecylphthalate) Cabflex	lb.	.305 / .335
Good-rite GP-265	lb.	.29 / .445
Hatco	lb.	.305 / .335
Rubber Corp. of America	lb.	.305 / .45
Ohopex Q-10	lb.	.295 / .33
R-9	lb.	.3525/ .3775
Orthonitro benzophenol, comml.	lb.	.13 / .15
Monsanto	lb.	.13 / .15
Palmalene	lb.	.15
Panaflex BN-1	lb.	.185 / .225
Para Flux, regular	gal.	.10 / .2125
No. 2016	gal.	.165 / .24
2332	gal.	.11
4205	lb.	.1075/ .2125
Para Lube	lb.	.046 / .048
Resins	lb.	.04 / .045
Paradene Resins	lb.	.07 / .08
Paraplex 5-B	lb.	.29 / .3475
Al-111	lb.	.32 / .3275
G-25	lb.	.76 / .77
-40	lb.	.4825/ .51
-50	lb.	.39 / .4175
-53	lb.	.4325/ .46
-60	lb.	.325 / .35
-62	lb.	.345 / .37
RG-7	lb.	.33 / .335
-8	lb.	.505 / .5125
-10	lb.	.52 / .5275
Pepton 22	lb.	.81 / .84
65	lb.	1.20 / 1.23
65-B	lb.	.81 / .84
Philrich 5	gal.	.11
Picco Resins	lb.	.135 / .195
480 Oilproof Series	lb.	.18 / .23
Aromatic Plasticizers	lb.	.05 / .065
Liquid Resin D-165 (Y)	lb.	.06 / .075
(Z-3)	lb.	.07 / .085
(Z-6)	lb.	.08 / .095
S. O. S.	gal.	.29 / .34
Piccocizers	lb.	.04 / .055
Piccolastic Resins	lb.	.1855/ .34
Piccolyte Resins	lb.	.205 / .245
Piccopale Resins	lb.	.12 / .135
Piccovars	lb.	.165 / .20
Piccovol	lb.	.025 / .038
Pictar	gal.	.25 / .30
Pigmentar	lb.	.046 / .0745
Pigmentaroil	lb.	.046 / .0745
Pine Tar, Sunny South	lb.	.046 / .0801
Oil, Sunny South	lb.	.046 / .0801
Pitch, Burgundy, Sunny South	lb.	.1030/ .1085
Plasticizers 42	lb.	.34 / .40
B	lb.	.35 / .45
DP-520	lb.	.435 / .455
MP	lb.	.035 / .0755
MT-511	lb.	.6925/ .7425
ODN	lb.	.35 / .475
SC	lb.	.40 / .515
Plastoflex #3	lb.	.52 / .57
#520	lb.	.36 / .435
DBE	lb.	.50 / .55
MGB	lb.	.29 / .37
SP-2	lb.	.43 / .48
VS	lb.	.3575/ .3975
Plastogen	lb.	.0775/ .08
Plastone	lb.	.25 / .32
Polycin 470	lb.	.325 / .34
Polycizers	lb.	.28 / .55
162	lb.	.285 / .44
Polymel C-128	lb.	.1775/ .1875
D	lb.	.225 / .235
D-TAC	lb.	.1975/ .215
DX, C-130	lb.	.1375/ .1475
Poly-Sperse AP-2	lb.	.23 / .295
AP-300	lb.	.26 / .325
LC-20	lb.	.26 / .425
PT67 Light Pine Oil	gal.	.60
101 Pine Tar Oil	lb.	.046 / .0634
Pine Tars	lb.	.046 / .0634
Reogen	lb.	.1325/ .135
Resin C pitch	lb.	.0225/ .031
R6-3	lb.	.38 / .40
Resinex 10, 25, 50, 110	lb.	.04 / .045
70	lb.	.0325/ .0375
85, 100	lb.	.035 / .04
115	lb.	.0375/ .0425
L-2, L-3, L-4, L-5	lb.	.0225/ .03
Rosin Oil, Sunny South	gal.	.58 / .875
RPA No. 2	lb.	.82
3	lb.	.48
Conc.	lb.	.85
5	lb.	.68
6	lb.	1.62
RSN Flux	gal.	.10 / .91
Rubber Oil B-5	lb.	.0225/ .0355
Rubberol	lb.	.18 / .2725
Santicizer 1-H	lb.	.50 / .51
3	lb.	.46 / .47
8	lb.	.43 / .44
9	lb.	.39 / .42
140	lb.	.325 / .36
141	lb.	.34 / .37
160	lb.	.25 / .28
601	lb.	.325
602	lb.	.305
B-16	lb.	.4875/ .4975

NOW-A Better Rotary Joint!

Patent Pending

SIZES
½" ¾" 1" 1¼"
1½" 2" 2½" 3"

NEW BARCO TYPE C Rotary Joint

Announcing...

It's new! It's simple! It's versatile! And for countless applications, Barco's new Type C Rotary Joint will give you the best operating records you've ever had.

FOR ALL SERVICES—One basic style of revolving joint for single flow or syphon flow ... one basic seal for steam, air, water, oil, gas—*or alternating hot and cold!* For temperatures to 450°F. Special to 500°F.

NO LUBRICATION NEEDED—Bearings and seal self-lubricating. Seal self-adjusting for wear. Long life without repairs or maintenance.

LOW TORQUE—Low starting and running torque*. Saves power. Suitable for any ordinary speed. To 200 psi, steam, or 400 psi, hydraulic.

COMPACT, SIMPLE—Malleable iron body; heat treated steel shaft; R.H. or L.H. thread. Eight sizes, ½" to 3".

*Typical example: 12 in. lbs. starting torque for 1" Type C on 100 psi water. Rotating torque, same.

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STEAM
WATER
OIL
AIR or GAS

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The Only Truly Complete Line of Flexible Ball, Swivel, Swing and Revolving Joints
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E-15	lb.	$ .5075	/ $	.5375
Santocizer	lb.	.4275	/	.4575
Sebacic acid, purified, comml.	lb.	.59	/	.65
Binney & Smith	lb.	.64	/	.76
Hardesty	lb.	.64	/	.76
C. P.- Binney & Smith	lb.	.72	/	.84
Hardesty	lb.	.72	/	.84
Sherolatum Petroleum	lb.	.05	/	.10
Softener #20	gal.	.10	/	.20
Special Rubber Resin 100	lb.	.1675	/	.2175
Staflex AX	lb.	.43		
DBES	lb.	.61	/	.635
Syn-Tac	gal.	.33	/	.35
Synthol	lb.	.17	/	.2625
Thiokol TP-90B	lb.	.59		
-95	lb.	.65		
Tricresyl phosphate, comml.	lb.	.33	/	.36
Cabflex	lb.	.345	/	.375
Monsanto	lb.	.325	/	.36
Naugatuck	lb.	.33	/	.36
PX-917	lb.	.33	/	.36
Triphenyl phosphate, comml.	lb.	.39	/	.40
Monsanto	lb.	.39	/	.40
Turgum S	lb.	.1075		.1175
Tysonite	lb.	.24	/	.2475
United	gal.	.69	/	1.20
X-1 Resinous Oil	lb.	.0225	/	.0325

Reclaiming Oils

Acintol C, P	lb.	.02	/	.03
Bardol, 639	lb.	.0275	/	.0375
B	lb.	.0625	/	.065
BRH 2	lb.	.0213	/	.0351
BRT 3	lb.	.018	/	.0265
4	lb.	.025	/	.026
7	lb.	.03	/	.031
BRV	lb.	.0475	/	.0565
Burco-RA	lb.	.053	/	.0805
BWH-1	lb.	.16	/	.18
Dipolymer Oil	gal.	.33	/	.43
Dispersing Oil No. 10	lb.	.06	/	.0625
G. B. Oils	gal.	.115	/	.275
Heavy Resin Oil	lb.	.0225	/	.0375
LX-572	gal.	.27	/	.32
-759	gal.	.1375		
-777, -809, -859	gal.	.23	/	.33
-869	gal.	.33	/	.43
-871	gal.	.34	/	.44
No. 3186	gal.	.28	/	.295
Picco 6535	gal.	.25	/	.30
C-33	gal.	.215	/	.315
-42	gal.	.23	/	.33
D-4	gal.	.27	/	.37
E-5	gal.	.25	/	.35
Q-Oil	gal.	.286	/	.36
PT 67	gal.	.60		
101 Pine Tar Oil	lb.	.0427	/	.061
150 Pine Solvent	gal.	.44		
Reclaiming Oil #3186	gal.	.28	/	.385
-G	gal.	.25	/	.365
4039-M	gal.	.3275	/	.3975
-Y	gal.	.30	/	.37
RR-10	lb.	.37		
S. R. O.	lb.	.015	/	.0225
X-1 Resinous Oil	lb.	.0225	/	.0325

Reinforcers, Other Than Carbon Black

Angelo Shellacs	lb.	.485	/	.7325
Borden, Chem. Div.				
Arcco 978-42B	lb.	.18	/	.19
1073-18B	lb.	.135	/	.145
1294-36B	lb.	.115	/	.125
1301-12B	lb.	.15	/	.16
BRC 20	lb.	.15	/	.175
22	lb.	.025	/	.0275
30	lb.	.0125	/	.021
521	lb.	.019	/	.02
Bunarex Resins	lb.	.065	/	.1225
Cab-o-sil	lb.	.68	/	.75
Calcene NC	ton	72.50	/	92.50
TM	ton	75.00	/	95.00
Calco S. A.	lb.	.85	/	.88
Clays				
Aiken	ton	14.00		
Aluminum Flake	ton	22.25	/	60.00
Buca	ton	45.00		
Burgess Iceberg	ton	50.00	/	80.00
Icecap K	ton	65.00	/	90.00
Pigment #20	ton	35.00	/	60.00
#30	ton	37.00	/	60.00
Catalpo	ton	35.00		
Crown	ton	14.00	/	33.00
Dixie	ton	14.00		
Franklin	ton	13.50	/	35.25
L. G. B.	ton	17.00		
Paragon	ton	13.50	/	33.00
Pigment No. 33	ton	37.00		
Recco	ton	14.00		
Suprex	ton	14.00	/	33.50
Swanee	ton	12.50		
Whitetex	ton	50.00		
Windsor	ton	14.00	/	30.00
Witco No. 1	ton	14.00	/	30.00
No. 2	ton	13.50	/	30.00
Clearcarb	lb.	.1175	/	.1255
Cumar Resins	lb.	.065	/	.17
Darex Resins	lb.	.42	/	.49
DC Silica	lb.	1.45	/	1.65
Diatomaceous silica	ton	32.00	/	48.00
Good-rite Resin 50	lb.	.39	/	.41
K Series Polymers	lb.	.15	/	.37
Hi-Sil 101	lb.	.14	/	.155
233	lb.	.08	/	.095
X303	lb.	.40	/	.45
Hycar 2001	lb.	.55		
2007	lb.	.39		

Indulins	lb.	$0.06 /	$0.08
Kralac A-EP	lb.	.43 /	.54
Laminar	ton	30.00	
Magnesium carbonate, Marinco CL	lb.	.105 /	.135
Marbon Resins	lb.	.39 /	.46
Multifex MM	ton	110.00 /	125.00
Super	ton	160.00 /	175.00
Neville Resins			
465	lb.	.075 /	.08
LX-509	lb.	.33 /	.35
Nebony	lb.	.045 /	.05
Paradene	lb.	.07 /	.08
R	lb.	.145 /	.205
Para Resins 2457, 2718	lb.	.04 /	.4575
Parapol S-Polymers	lb.	.44	
Picco Resins	lb.	.13 /	.225
Piccolyte Resins	lb.	.205 /	.275
Piccoumaron Resins	lb.	.07 /	.19
Piccovars	lb.	.145 /	.20
Pliolite NR types	lb.	.98 /	1.33
S-3, -6	lb.	.42 /	.49
-6B	lb.	.39 /	.46
Plio-Tuf G85C	lb.	.52 /	.59
Purecal M	ton	56.75 /	71.75
SC, T	ton	110.00 /	125.00
U	ton	120.00 /	135.00
R-B-H 510	lb.	.15 /	.22
Resinex	lb.	.0225/	.1025
Rubber Resin LM-4	lb.	.28 /	.35
Silene EF	ton	120.00 /	140.00
Silvacons	ton	55.00 /	85.00
Transphalt	lb.	.0225 /	.0525
Witcarb R	ton	105.00 /	120.00
-12	ton	45.00 /	66.00
Zeolex 23	ton	120.00 /	140.00
Zinc oxide, commercial†	lb.	.135 /	.1775

Retarders

Benzoic acid TBAO-2	lb.	.44	
E-S-E-N	lb.	.37 /	.39
Good-rite Vultrol	lb.	.62 /	.66
R-17 Resin	lb.	.1075/	.36
Retarder ASA	lb.	.57	
J	lb.	.62 /	.64
PD	lb.	.37 /	.39
W	lb.	.42	
Retardex	lb.	.47 /	.50
Thionex	lb.	1.14	
Wiltrol P	lb.	.37 /	.39

Solvents

Bondogen	lb.	.55 /	.60
Butyrolactone	lb.	.60 /	.65
Cosol #1	gal.	.37 /	.43
#2	gal.	.42 /	.48
Dichloro Pentanes	lb.	.04 /	.07
Dipentene DD, Sunny South	gal.	.40 /	.62
Ethylene dichloride, comml.	lb.	.09 /	.122
Hi-Flash 2-50-W	gal.	.41	
Pale yellow	gal.	.39	
LX-572	gal.	.27 /	.32
-748	gal.	.16 /	.23
Methyl-2-pyrrolidone	lb.	.75 /	.80
Neville Nos. 100, 104	gal.	.52 /	.60
106	gal.	.38 /	.46
Nevsolv H, 200	gal.	.19 /	.29
HF, T, 30	gal.	.24 /	.34
Penetrell	gal.	.40 /	.62
Picco Hi-Solv Solvents	gal.	.16 /	.48
Pine Oil DD, Sunny South	lb.	.1225/	.1425
PT 150 Pine Solvent	gal.	.44	
Skellysolve-B	gal.	.17	
-H	gal.	.148	
-R, -V	gal.	.139	
-C	gal.	.162	
Stauffer Carbon Disulfide	lb.	.0525/	.085
Tetrachloride	lb.	.0825/	.475

Tackifiers

Acintol R	lb.	.065 /	.07
Bardol, 639	lb.	.0275/	.0375
Borden, Arcco			
A25, A26, 716-30	lb.	.18 /	.19
555-40R	lb.	.185 /	.205
620-32B	lb.	.20 /	.21
716-35	lb.	.17 /	.18
1041-21	lb.	.165 /	.175
BRH 2	lb.	.0213/	.0351
Bunarex Resins	lb.	.065 /	.1225
Chlorowax 70	lb.	.18 /	.24
Contogums	lb.	.0875/	.11
Cumar Resins	lb.	.065 /	.17
Galex W-100	lb.	.155 /	.17
W-100D	lb.	.1525/	.1625
Indopol H-35	gal.	.65 /	.81
H-50	gal.	.70 /	.86
-100	gal.	.85 /	1.05
-300	gal.	1.00 /	1.21
L-10	gal.	.40 /	.56
-50	gal.	.45 /	.61
-100	gal.	.55 /	.71
Kenflex resins	lb.	.18 /	.27
Koresin	lb.	.90 /	1.10
Natac	lb.	.12 /	.13
Nevindene	lb.	.15 /	.18
Picco Resins	lb.	.13 /	.185
Piccolastic Resins	lb.	.1855/	.34
Piccolyte Resins	lb.	.185 /	.25
Piccopale Resins	lb.	.089 /	.13
Piccoumaron Resins	lb.	.07 /	.185
R-B-H 510	lb.	.15 /	.22
Roelflex 1118A	lb.	.39	
Synthetic 100	lb.	.41	
Synthol	lb.	.17 /	.2625
United	gal.	.69 /	1.20

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Ko-Blend I. S.	lb.	.39	
Litharge (*See Accelerator-Activators, Inorganic*)			
Magnesium oxide	lb.	.2525 /	.38
Maglite D, K	lb.	.2575 /	.285
M	lb.	.2975 /	.325
Red Lead (*See Accelerator-Activators, Inorganic*)			
Sulfasan R	lb.	1.50	
Sulfur flour, comml.	100 lbs.	2.55 /	3.30
Aero	100 lbs.	2.40 /	7.75
Crystex	lb.	.195 /	.23
Insoluble 60	lb.	.15 /	.155
Rubbermakers	100 lbs.	2.65 /	4.55
Stauffer	lb.	.0265 /	.054
Telloy	lb.	2.50	
VA-7	lb.	.50 /	.60
Vandex	lb.	15.50	
Vultac No. 2	lb.	.47 /	.755
3	lb.	.51 /	.795
White lead silicate (*See Accelerator-Activators, Inorganic*)			

NEWS FROM ABROAD

(*Continued from page 578*)

France

Fransil—Silica Reinforcer

Société Fransol, jointly owned by the Franterre and Pechiney concerns, has developed the first French dispersed silica reinforcing fillers by a completely new electro-thermal process, covered by world-wide patents. Fransil, as the product is called, is marketed in two grades: Fransil EL, a very fine powder, oily to the touch and very light in weight (apparent density 60-80 g/liter); and Fransil 251, a de-aerated, slightly compressed powder (apparent density 250 g/liter) especially intended for the rubber industry.

In a dry state, Fransil 251 contains SiO_2, 98.5-99%; Fe_2O_3, 0.2%; Al_2O_3, 0.7%; CaO, 0.1%; traces of TiO_2, undeterminable alkaline elements, but no manganese or copper. The particles of the material are almost perfectly spherical, and their average diameter is about 40 millimicrons. X-rays reveal Fransil 251 to be amorphous.

Because of the way this product is prepared, it has much less surface activity than usual silicas and so has little tendency to absorb moisture or plasticizers and other compounding ingredients, factors which contribute to the ease with which Fransil 251 mixes can be processed, it is claimed. It is almost as easily incorporated in the mix as certain types of whiting, even in large proportions; in the laboratory, on laboratory equipment, 200 grams were incorporated in 200 grams of natural rubber in five minutes.

Fransil 251 is said to improve plasticity and processing qualities in general; it is highly reinforcing—values for tensile and tear strength and abrasion resistance are very high—but modulus and hardness are relatively low for a given volume of filler; hence more of it must be used to obtain the same degree of hardness as with HMF carbon black or an American silica, for instance, and this can be done without lowering mechanical properties. Rate of cure is hardly affected; so no unusual amounts of accelerator or ultra-accelerator need be added, but activated forms of mercaptobenzothiazole should be used.

According to the manufacturer, Fransil 251 compares with other white or black fillers as follows: (1) it is like MPC carbon black in general quality level and like SRF carbon black as to modulus; (2) it gives lower modulus than other silicas and permits heavier loading without change in mechanical properties; (3) it shows much higher tear strength than reinforcing clays and colloidal kaolins; (4) it shows definite overall superiority to precipitated calcium silicate and is much easier to process.

Fransil 251 gives excellent results not only in natural rubber, but also with SBR, neoprene, nitrile and butyl rubbers, etc., and cannot only replace the classic fillers for various purposes, but also can successfully be combined with some of them to give improved mechanical and/or processing properties. It is recommended for tire tread compounds (heat build-up is as low as for channel blacks), inner tubes of butyl rubber, caterpillar tracks, V-belts, heels and soles, and sanitary goods.

Russia

English Rubber Machinery Ordered for Tire Factory

The visit to Moscow in March, 1957, by a party representing five large British companies manufacturing equipment for the rubber industry has borne fruit. The delegation, headed by J. G. Mackay, of Francis Shaw & Co., which included also K. Bradshaw, of David Bridge & Co.; J. B. Scott, of Crompton Parkinson; H. Willshaw and H. Smith, of Dunlop Advisory Service, succeeded in the face of competitive bids by the United States, France, and Germany, and after a month of negotiating, in securing a contract to supply rubber manufacturing equipment and electrical equipment for a tire factory now under construction. When completed, this factory is expected to be the largest in the world outside of the United States and will manufacture a complete range of tires for passenger cars as well as for all kinds of commercial vehicles, trucks, and tractors. The five companies have formed a consortium to handle the contract.

According to recent news releases, Russia produced 465,000 motor vehicles in 1956, or 4% more than in the preceding year; these included 358,000 trucks, 98,000 passenger cars, and 9,000 motor buses. The output of tires last year was said to have increased by 11% to 11,300,000 units.

Yugoslavia

The rubber goods factory Tigar, in Pirot, is to be rehabilitated, a government decision reveals. At the same time a new tire factory will be built to permit annual production by Tigar to be raised to 118,000 automobile tires, 147,000 tubes, 750 tons of mechanical goods, and more than 2,000,000 pairs of rubber footwear.

Hitherto a large part of the country's requirements in tires as well as of other rubber goods had to be imported, mainly from Italy, Israel, and the United Kingdom, since the combined output of two local factories, said to include 78,000 automobile tires annually, is far below the country's needs.

At the end of 1956, Yugoslavia had 11,523 passenger cars, 21,985 trucks, 1,955 buses, and some 12,000 motor cycles.

Nigeria

Attention is being called with increasing frequency to Nigeria as a potentially important rubber country. The latest to point to its possibilities in this respect is Lord Harlech, chairman of the Bank of British West Africa, Ltd. More rubber buyers are turning to Nigeria, he is quoted as stating; quality of local rubber has improved, and a regular demand for larger quantities seems to be in prospect.

About the same time that these remarks were published, it was learned that two well-known Malayan rubber companies had decided to participate in the Illushin Estates Co., Nigeria, newly formed to grow rubber there. The Malayan companies are Batu Caves and Seafield, which have the same board and secretaries; the former has already subscribed £20,000 for shares in the Nigerian enterprise, and Seafield will subscribe £30,000.

Borneo

British North Borneo is embarking on a program of extending plantings of high-yielding rubber. The North Borneo Rubber Fund Board has ordered four million rubber seeds from Malaya to be delivered between August, 1957, and March, 1958. A further one million seeds may also be obtained. It is expected that this material will be sufficient to produce enough clonal stumps to plant at least 10,000 acres in 1958.

In 1956 this colony exported 19,860 tons of rubber, a decrease of 200 tons compared with 1955 exports. Of the other Borneo territories, Sarawak increased exports by almost 2,000 tons in 1956 to a total of 41,268 tons; Brunei shipped 1,351 tons, against 1,442 tons.

Italy

The synthetic rubber factory being built in Ravenna for Azienda Nazionale Idrogenazione Combustibili, scheduled to open in the Spring of 1958, may be ready to operate as early as the end of 1957. It is at the same time learned that the works will be equipped to produce 60,000 tons annually of SBR rubber based on methane gas, instead of 30,000 tons as reportedly originally planned.

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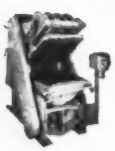

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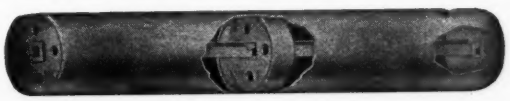

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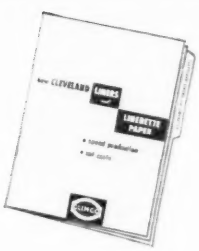

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